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International Vital Statistics of the Future*

FORREST E. LINDER, PH.D.

Assistant Chief, Division of Vital Statistics, Bureau of the Census, Washington, D. C.

PERHAPS most of the statistical analysts here can recall their first experience in making a comparative vital statistics study for various countries of the world. After a few days of hard work in the library it was soon discovered that it is very difficult if not impossible to make satisfactory world-wide vital statistics studies. Data for even some of the large countries are not available; there is a wide variety of methods of compilation and classification; and there exist no general standards for completeness and accuracy.

Confronted with such a situation, the analyst is likely to give some thought to the problems of collecting and compiling vital statistics so that international studies would be possible. Obviously, progress toward the desirable goal of world-comparable vital statistics depends upon a clarification of the responsibilities and interests of the numerous governmental units which contribute to the production of those statistics. In the United States, the city, the county, the state, and the federal government each has an essential and a distinctive responsibility in the United States vital statistics collecting organization; and, in turn, each has its own distinctive uses and needs for the records and data it has helped to collect. A similar pattern will be found in other countries. And beyond the scope of national government, those official and private organizations concerned with international problems of health or health statistics have a contribution to make to, and a real interest in, hemisphere or world vital statistics.

The fact that each unit in the governmental hierarchy, from the smallest town to the most global world organization, has an interest in vital statistics is no indication that these interests are the same. The smaller units of government need and can produce intensive and detailed analyses of local data. The work of each larger governmental unit becomes successively more *extensive* and correspondingly less *intensive*. No

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state vital statistics office could hope to duplicate the type of intensive demographic studies which can be made in a progressive city office. In such a local office, data can be tabulated on a tract basis and studied in relation to other tract data with a direct knowledge of pertinent local conditions. The data can be tabulated week by week or day by day, and if necessary, cases can be individually listed for exhaustive special investigation. The state office has the opportunity for more extensive analyses based on consolidated data for the whole state or upon the comparison of areas within the state. But to the degree that the state totals are a consolidation of heterogeneous data or that the comparisons involve noncomparable areas, the possibility of detailed study is lost. Similarly the work of our national agencies, based on interstate comparisons or on consolidated data for 48 states, loses in detail and validity as much as it gains in scope and generality. In the international field the extensity of interest is so great and the data under consideration are so heterogeneous that it is difficult to make even the vaguest conclusion or the most general comparison.

Although the contributions and requirements of each unit in the vital statistics organization are different, they are by no means independent. The vital statistician for any city can analyze his material on an *internal* basis, taking into consideration differences and facts within his area. However, much would be added to the value of his analysis if it were also studied on an *external* basis by making comparisons between his city and others. The vital statistics for the whole United States are of more value when viewed against a background of international vital statistics, and if there are men on Mars, I assume that the global statisticians will some day be making interplanetary comparisons.

The interest of the statistician for one area in the vital statistics of other areas is not due to the need of data for external comparisons only. A factor of greater importance is the interdependence of the various areas of the country with regard to health conditions. Health conditions in your own city, state, or country which result in unfavorable mortality would be of importance to you. Similar health conditions in an adjacent area might be of equal interest if there was a danger of them spreading. A health official in Maine might well be concerned with the vital statistics of a potential epidemic in California. In these days of rapid world transportation, the United States must become more and more concerned with the vital statistics of the other nations of the globe with whom we maintain social and economic relations. Like wars, epidemics have no respect for political boundaries.

This dual dependence of the medical statistician in one area upon the data produced by a statistician in another area is a strong unifying force which has advanced vital statistics further along the road to world comparability than any other statistical field. In effect, it means that the statistician in any unit of the system has a real and legitimate interest in the methods, procedures, and programs of every other unit. Each unit within a state has an interest in the work of the state vital statistics office because the activities of that office affect the type of external statistics which a city or county may be able to get. Each state statistician has a legitimate concern and responsibility wth the problems of national collection because the actions or recommendations of a national agency may facilitate or hinder the essential external studies made by the various states. Each national government has a responsibility to partake in and contribute to those international activities

which have world comparability as their ultimate goal.

When every governmental unit contributes to and in turn is dependent upon a vital statistics system, is it too much to hope that ultimately we shall have an integrated and coördinated world vital statistics system?—and that then, the elusive goal of "comparability" will become somewhat more of a reality?

Such a concept of a world vital statistics system carries with it no necessary implication of a super world government. More, perhaps, can be attained by the coöperative efforts of the independent countries working together with some international coördinating agency. Much more can be accomplished by such methods than is ordinarily realized. Take a single example from our own voluntary system of federal-state vital statistics. Make this simple test: On a table, spread out copies of the death certificates in use by each of the independent state and city death registration units. Then, spread out the records for some other state activity—such as marriage certificates, or licenses for automobile drivers. Among the death certificates you will note a surprisingly high degree of uniformity and comparability. Among the other records, you will almost certainly find a great variation.

The state-to-state uniformity of the death records is the result of no mandatory national law but is rather one of the many results of 40 years of continuous coöperative effort between national, state, and city officials—each realizing his responsibility in and his need for a coördinated organization.

Already substantial progress has been made in the field of international comparability of vital statistics. The almost universal use of the *International List of Causes of Death* represents an achievement that has no counterpart in any other statistical field. Widespread recognition of the need for better international vital statistics is opening the door for further progress. The Eighth American Scientific Congress, the Fourth Pan American Conference of National Directors of Health, the XI Pan American Sanitary Conference, the First Pan American Conference on Social Security are some of the inter-American conferences of recent years which have adopted specific resolutions and recommendations calling for an improvement in national and international vital statistics. In the Western Hemisphere several inter-American agencies are taking active steps to assist in coördinating and stimulating efforts for the development of vital statistics among the American Republics. The Pan American Sanitary Bureau and the Inter American Statistical Institute are both actively interested in improving sources and comparability of demographic data.

The inter-American program of the Vital Statistics Division of the Bureau of the Census can be considered as one small contribution to the solution of the problems of international vital statistics. This program has four interrelated parts. The first part involves the lending of technical consultants to other American Republics that request such assistance for the reorganization or improvement of their vital statistics methods. Under this program one Census Bureau field consultant is working in the Caribbean Area and another is in Central America. Several additional projects are now being formulated for South America.

A second part of the program involves offering fellowships to South American vital statisticians who wish to study in this country. This part of the program is not yet under way, but it will probably be started on a small scale this year. In addition to its own fellowship program, the Bureau is coöperating with other governmental

and non-governmental agencies by offering some training in the administrative aspects of vital statistics to students brought to the United States by those other agencies.

The third part of the Census Bureau program is a systematic compilation from published sources of vital statistics data for each of the American Republics. Such compilations have been completed for 3 countries and during the course of the next 12 months, demographic compilations will be undertaken for 17 others. These compilations will ultimately form the foundation for a comprehensive study and analysis of the demographic and public health problems of the Western Hemisphere.

The fourth aspect of the Census Bureau program is an effort to improve and standardize vital statistics methods by the preparation and distribution of those "tools" which a vital statistician needs in his work. An elementary manual on vital statistics has been prepared, translated into Spanish, and published by the Ministerio de Salud Pública of the Republic of Uruguay. This *Manual de Estadística Vital* has been reprinted and given wide distribution by the Census Bureau. It is also being reprinted in the official statistical journal of one South American country and is being translated into Portuguese for publication in the official statistical journal of Brazil. In order to provide a tool for the conversion of technical matter from one language to another, the Bureau has prepared and distributed a *Vocabulario Bio-estadístico* which gives Spanish-English equivalents of some 1,600 common terms used in vital statistics. Plans are also being made for the preparation of a Spanish edition of the index of the *International List of Causes of Death* and the conversion of other "work tools" of the statistician to a bilingual or multilingual basis.

There is no mistaken optimism that this program will quickly solve the problems of inter-American comparability and that we may now expectantly look forward to the immediate availability of adequate medical statistics for the American Republics. The goals are difficult and far from attainment.

There is little agreement of opinion even within our own country regarding the ideal goals of a vital statistics system and the proper methods of attaining those goals. Before much can be accomplished in the international field these objectives must be more clearly formulated and the prerequisites and methods for the system must be more adequately explored. In addition, some fundamental problems of organization must be solved. The most optimistic sign is the general recognition of the fact that although the needs of different units of the statistical system are distinct, their interests are interdependent. Substantial progress from now on will require the coöperative work of local, state, national, and international vital statisticians.

Army Field Water Supply Developments*

HAYSE H. BLACK, C.E.

Captain, Corps of Engineers, Chief, Water Supply Equipment Branch, The Engineer Board, Fort Belvoir, Va.

THERE are few items of Army supply more important than potable water. Production of potable water in adequate quantities for field troops is just one of the many and varied military assignments of the Corps of Engineers. Global mechanized warfare has introduced innumerable water supply and water treatment problems heretofore not conceived. The purpose of this paper is to cite some of the more important water supply developments resulting from American participation in World War II.

Some conception of the problems confronting the Corps of Engineers may be realized from consideration of the fact that provision must be made for supplying potable water to the individual soldier, whether he be a part of a small detachment on an isolated island or a member of an organization making up a field army. The water supply problems of task forces are frequently more complicated than those presented by larger troop movements. The widespread dispersion of American forces has recently been discussed by General George C. Marshall, Chief of Staff of the U. S. Army, in his biennial report to the Secretary of War, where he reported that American troops were stationed in 51 different places around the world. This is indicative of the potential water supply problems.

The field army will be forced to utilize such sources as sea water, grossly polluted streams, and brackish well waters in addition to more acceptable ones. These conditions make it imperative that equipment and processes be available to permit the accomplishment of military missions, and Army water supply processes and equipment are designed to meet the highly variable field conditions anticipated.

ORGANIZATION, FACILITIES AND EQUIPMENT

The Engineer Board is the development agency for the Corps of Engineers, operating under the general direction of the Engineering Division, Office, Chief of Engineers, U. S. Army. The Water Supply Branch of the Engineer Board is charged with the conduct of research and development pertaining to water supply for the Army.

The main offices of the Engineer Board are located at Fort Belvoir, Virginia, where administrative functions, research, and a substantial portion of the development are conducted. Field parties are established in areas where the environment is conducive to special testing. The Water Supply Branch maintains two extensive field sections

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FIGURE 1—Water Supply Branch Laboratory, Equipment Test Room

for testing and development of water supply equipment. Well equipped shops and field offices are provided for these sections for maintaining and servicing units under test.

The Water Supply Branch Laboratory, recently completed, was designed for its special tasks. This modern laboratory is equipped for chemical and bacteriological analytical work, water purification and hydraulic studies, and physical testing of water supply mechanical equipment. A spectrograph, complete with comparator-densitometer, is provided for qualitative and quantitative chemical analyses. Abundant space is available for pilot plant and full scale studies. Equipment being developed is subjected to full scale testing prior to being recommended to the Chief of Engineers for adoption. A view of a portion of the laboratory is shown in Figure 1.

WATER PURIFICATION

Recent desert warfare focused attention on water distribution when its scarcity necessitated transporting it long distances. This is an abnormal military function and every effort is made to reduce the length of haul for water to an absolute minimum. This means that in those areas where water is available, it is expected that such treatment as is necessary will be employed to produce a satisfactory and safe drinking water. Satisfactory accomplishment of water purification under all field conditions is a foregone conclusion to the American soldier who in civilian life was accustomed to uninterrupted water service.

Although basic principles of water purification are well established, the adaptation of them to field Army requirements presents many problems which do not normally concern water

works men. Full cognizance is taken of the fact that proven design factors and operation procedures for water purification in fixed installations may be relied upon to produce a safe treated water. These same principles, however, when applied to portable equipment, frequently introduce complications. It will be appreciated that the multiplicity of Army field water supply problems invite and occasionally result in deviations from standard water works practice.

Current standard mobile and portable water purification equipment tends toward excessive filtration rates and inadequate pretreatment of the water to be filtered. This is a natural consequence of an attempt to produce the maximum amount of potable water with a minimum of equipment and supplies. The efficiency of this field equipment has been studied in collaboration with the National Institute of Health, U. S. Public Health Service, in order to determine its limitations and to establish optimum operating procedures. Improved results are attainable through reduced filtration rates and provisions for intermediate coagulation and sedimentation. Although these modifications result in an improved filtered water, treatment with germicidal agents continues to be an extremely important step in producing a potable water.

Novel water problems appear in foreign areas. Schistosomiasis, which is virtually unknown in the United States, is endemic in many tropical and subtropical countries. The disease is caused by cercariae, which enter the body through the skin and thus become a bathing as well as a drinking water problem. Due to the resistance of the cercariae to chlorine and their ability to penetrate sand filters, it becomes necessary to resort to longer storage, higher chlorine residuals or improved filtration when these organisms are present in the raw water. Present practice favors chlorine rather than chloramine as a cercaricide but their relative efficiency is still in doubt and is to be investigated.

Manufacture and distribution of water purification chemicals in wartime present new and unusual problems. Demand for chemicals frequently prohibits normal refinement in the finished product, necessitating tolerance of impurities not commonly accepted. New processes have been developed for manufacture of coagulants, giving products which will contribute to postwar water treatment. As a result of these developments, satisfactory water purification chemicals have been made available in quantities to satisfy Army requirements.

Studies of calcium hypochlorite have shown a definite correlation between moisture content and container corrosion. High moisture (10 to 20 per cent) calcium hypochlorite has been found to cause failure of metal containers in one year's storage. An interesting observation in this study has been the stability of this product. Calcium hypochlorite, in corroded containers allowing exposure to the atmosphere, still retains approximately 75 per cent of its original available chlorine content. However, there is ample justification for specifying a low moisture product; that is 2 per cent moisture or less.

Facilities have been made available for sterilization of large quantities of either filtered or untreated water. Commercial equipment has been incorporated into a protective framework, along with solution reservoir, water meter, water line connection and diffusor tube. The apparatus applies sterilizing agent in direct proportion to the main line flow, being operated by water under pressure from the supply. This equipment is flexible, and by improvising it can be made to

treat water over a wide flow range. This particular equipment is well adapted for treatment of municipal water supplies in occupied areas.

DIATOMACEOUS SILICA FILTRATION

Research has been directed toward effective, lightweight, portable water filtration equipment. Diatomaceous silica has been intensively investigated by the Engineer Board during the past six months as a possible filter medium to replace sand now being used in Army water filtration equipment. The excellent results obtained from these studies indicate that diatomaceous silica filtration is superior to sand filtration for portable water purification equipment.

Inasmuch as diatomaceous silica is a relatively new medium for water filtration, the following description should be helpful in understanding this application. Diatomaceous silica is the refined product obtained from sedimentary diatomite, the deposits of fossil valves or shells of diatoms. The diatom, a single-celled marine plant, which is related to algae, secretes a siliceous frustule consisting of two valves which inclose the entire shell. Deposits of diatomaceous silica (the unrefined product is commonly known as diatomaceous earth or Kieselguhr) were formed in shallow water during the Miocene period and subsequently raised above sea level to form deposits along the Pacific coast in this country. Diatomite is mined in open pits, crushed, classified, and treated to produce a variety of commercial filter-aids that have been used for a number of years by the process industries in the clarification of sugars, chemicals, oils, fruit juices, varnish, and other liquids. The principal component parts of the diatomaceous silica filter are the diatomaceous silica itself and a rigid support, hereafter referred to as filter membrane, upon which the filter medium forms as a porous filter cake. Extensive tests have been conducted with different types of filter membranes such as those constructed of aluminum oxide, carbon, and Monel wire. Rigid, porous filter tubes made of aluminum oxide or carbon and wire-wound fluted cores appear to be superior to other types of filter membranes tested.

The diatomite filter is placed in operation by applying an initial layer of filter-aid known as "precoat," which is formed by pumping a suspension of diatomaceous silica (0.1 to 0.15 lb. per sq. ft. of filter surface) through the filter membrane at the rate of 2 to 4 gal. per sq. ft. per minute. The water containing this suspension is circulated until the material is deposited and until the filtered water is free from turbidity. Enough water, preferably filtered, to fill the system is used in mixing the diatomaceous silica suspension. Flow through the filter membrane is inversely proportional to the resistance, causing a coat of uniform thickness to form.

Inhibition of an impervious "schmutzdecke" is accomplished by continuous addition of the diatomaceous silica to the water being filtered. The diatomaceous silica added during the filter run is termed "body-feed." The body-feed combines with the suspended materials to form a cake that remains porous, permitting extended filter runs at reasonable pressures. The amount of body-feed required varies with the amount and nature of the suspended matter in the water. Tests indicate that the ratio of filter-aid to turbidity by weight is approximately 1.25 to 1 for inorganic silt and 3 to 1 for organic slimes. Body-feeding has been accomplished by utilizing pressure differentials such as that produced by pump suction or a Venturi throat, but it is believed that positive and proportional mechanical feeding is preferable.

The filter cake is readily removed by reversing the flow through the filter membrane. Normally, the filter is

allowed to drain, after which approximately 10 gal. of filtered water per sq. ft. of filter surface is pumped in reverse through the filter membrane at a rate of 7 to 10 gal. per sq. ft. per minute. The filter cake may be easily removed by air in lieu of backwash water.

Tests conducted in collaboration with the National Institute of Health, U. S. Public Health Service, have shown that diatomaceous silica filtration will effect complete removal of the cysts of *Endamoeba histolytica*. NRS strain cysts were used in this research. This type filtration has likewise been proved to be highly effective in removal of bacteria. Rapid sand filtration, at rates in excess of the accepted standard, was proved ineffective in removal of the NRS strain cysts of *Endamoeba histolytica*. Special tests were conducted with intermittent flow and vibration of the diatomaceous silica filter unit to simulate adverse operating field conditions with the result that no cysts appeared in the filtered water from correctly designed units. The results of these tests demonstrated that diatomaceous silica will accomplish complete removal of *Endamoeba histolytica* cysts irrespective of the nature of the raw water or the concentration of the cysts at flow rates as high as 7 gal. per sq. ft. per minute.

Removal of turbidity with diatomaceous silica filtration is essentially complete. Suspensions of extremely fine clay or algae have been readily filtered, producing a filtered water that gives no tyndall effect when a strong beam of light is passed through the water in a darkened room. This corresponds to a turbidity of absolute zero on any turbidimeter in use, a turbidity of 1.0 p.p.m. on the St. Louis turbidimeter, giving a solid cone of reflection in the light beam. Tests indicate that the removal of microorganisms may be highly effective. Since a close correlation between the amount of turbidity and the number of microörganisms was found in all tests, water producing no tyndall effect may approach sterility. Activated carbon introduced with body-feed has been used to remove tastes, odors, and color.

The quality of the filtrate appears, within limits, to be independent of the flow rate for a given filter-aid. This characteristic of diatomaceous silica filtration permits relatively high filtration rates as compared with sand filtration. The clarity of the filtrate produced with proper grades of filter-aid is striking. Turbidities ranging from 0 to 0.3 p.p.m. on the St. Louis turbidimeter or tyndall effect instruments have been consistently attained. Particle size for diatomaceous silica ranges from 0.5 to 12.0 microns, whereas filter sand may vary from 300 to 600 μ. Considering the particle size, the mechanical straining action may be expected to be much more effective with diatomaceous silica than with sand and with relatively thin layers of this material. Furthermore, the indented diatom valves may be expected to perform more efficiently than relatively smooth grains of sand in removing particles by adhesion. Tests have shown that the use of minute amounts of coagulants with filter-aid will produce a filtrate that gives no tyndall effect with a strong beam of light.

Average flow rates have been steadily increased as a result of this research from approximately 2.5 to 6.0 gal. per sq. ft. per minute when filtering water containing 200 p.p.m. of alluvial clay. Higher flow rates are in prospect with treated filter-aids and using higher capacity, higher pressure pumps. The military value of diatomaceous silica, as a filter medium, becomes most apparent when it is realized that the precoat requires only 0.1 to 0.15 lb. of material per sq. ft., whereas the conventional sand filter requires approximately

200 lb. of sand to give 1 sq. ft. of filter surface.

Since effective coagulation and sedimentation are not required with diatomaceous silica filtration, operation becomes independent of chemical constituents in the raw water when treated filter-aids are used. Filtration operations are accordingly simplified. Water of high turbidities may be filtered at high rates by increasing body-feed, producing the same quality of filtered water as obtained from low turbidity sources.

Advantages of diatomaceous silica over other recognized filter media for water may be summarized as follows:

1. Higher output per unit weight
2. Improved quality of filtered water
3. Simplified operation

Cognizance is taken of the fact that diatomaceous silica filtration of water must prove its worth to the water works profession. It is further realized that there are still many unknowns in the study of diatomaceous silica filtration. Results of studies conducted by the Engineer Board indicate that diatomaceous silica approaches an ideal filtering medium for use in portable water filtration equipment and that its potentialities should attract the interest of research workers in the water works profession.

GROUND WATER DEVELOPMENT

There are large areas in the world likely to be occupied by American troops where dependence must be placed upon ground water. This situation has necessitated providing equipment to locate and produce ground water under a great variety of conditions. In undertaking this work, cognizance has been taken of the fact that machines and equipment, used commercially in developing ground water supplies, have evolved through years of experience of dependable manufacturers with the benefit of advice from skilled and critical well drillers. It has been possible for the most part to adapt available commercial equipment to specific military purposes.

A primary consideration in the development of well drilling equipment for military work is the decision relative to the proper accessory equipment and spare parts to accompany each machine going into the theater of operations. The spare parts problem is alleviated somewhat by standardization of equipment. Every effort is made to

FIGURE 2—Lightweight Rotary Well Drilling Rig

control design so as to reduce maintenance to an absolute minimum. Army requirements place special emphasis on such features as flexibility, mobility, and maneuverability of equipment. Due consideration is given to such factors as weight and volume of equipment and supplies. Speed of drilling and the ability to produce water in a minimum of time are of paramount importance.

In the past, there has been considerable controversy over the relative merits of the rotary and the cable tool methods for drilling water wells. There are certain geologic conditions which dictate cable tool drilling and there are other conditions when the rotary drill must be used. Cable tools are unsatisfactory and at times inoperative in soft, loose, unconsolidated caving formations; such as dune sand, quicksand, unconsolidated river gravels and for small diameter deep holes in unconsolidated material. Rotary machines are unsatisfactory and at times inoperative in cavernous or extremely porous "lost circulation" zones. These limitations make it mandatory that a well rounded water well drilling organization have available both types of equipment and trained personnel capable of handling each type.

Development work with well drilling equipment has resulted in a lightweight rotary drill. The objective of this design has been to provide highly flexible equipment possessing maximum maneuverability. This equipment is designed for exploratory drilling and demolition work as well as prospecting for water wells. A hydraulically-actuated diaphragm mud pump is an interesting component of this rotary drill. The accompanying picture, Figure 2, illustrates the drill proper.

A considerable amount of work has been done in the development of hi-lift pumping equipment for small diameter water wells. The objective of this work has been to develop dependable pumping equipment which will give maximum production from small diameter water wells. Due to limitations of weight and transportation, it is impractical to drill normal industrial type, large diameter deep holes in field military operations. Design of deep well pumping equipment is consistent with capacities provided in the Army well drilling rigs and suitable for use in water wells drilled in world-wide military operations.

The development work pertaining to ground water has resulted in equipment which should prove valuable to the industry following the war. Data have been accumulated which should be of use in other phases of Corps of Engineers operations. Reference is made to application in pumping of mud fluids, slushes, cement grout, chemicals, and fluids containing suspended solids.

WATER DISTILLATION

The Engineer Board, in collaboration with interested manufacturers, has performed pioneering research in development of portable sea water distillation equipment. This development work was initiated late in 1940. Phenomenal progress has been made during this period and equipment is now available which gives economies heretofore considered fantastic.

Distillation equipment is used to produce potable water for troops, or water low in total solids for other military purposes, from sea water, brackish water, and other waters containing excessive amounts of dissolved solids. This development has resulted in portable, compact, self-contained equipment complete with power plant, source of heat, pumps, accessories, and controls. Design of this equipment has taken into consideration necessary ruggedness to withstand military handling and simplicity to assure satisfactory operation by soldier personnel.

Single effect, multiple effect, and thermocompression distillation equipment have been developed. This equipment may be classified into two groups according to the source of heat for operation:

1. Oil-fired in which heat is supplied to a steam generator or boiler by burning liquid fuel for single and multiple effect equipment.
2. Compression type in which heat for evaporating water is supplied from compressed steam.

Initially, development was focused on single and multiple effect direct oil-fired distillation equipment. Through a progressive development program, economies were realized up to 36 lb. of distillate per lb. of fuel consumed. Multiple effect distillation equipment utilizes latent heat of vaporization of steam generated in the first effect evaporator to evaporate additional water in subsequent effects, thereby increasing economy of the unit. Direct oil-fired stills possess certain inherent advantages in that they permit heating of water and production of steam for other military field uses.

Ferrous metals are utilized where possible in lieu of materials more resistant to corrosion by sea water. Extensive service of such equipment has shown that deterioration is not a serious factor and that the direct-fired equipment of essentially ferrous construction is satisfactory for military field use.

The objective in continued development of distillation equipment has been to increase economy without sacrificing weight, ruggedness, and simplicity. Compression type distillation equipment most nearly approaches this objective. The successful development of portable compression type distillation equipment constitutes an outstanding advancement in the field of distillation. The initial source of power and heat for compression type distillation is a water-cooled engine. The steam compression cycle is started by passing steam from the engine water cooler to the steam dome of the evaporator. Raw water which has been preheated in a highly efficient heat exchange system is passed into an

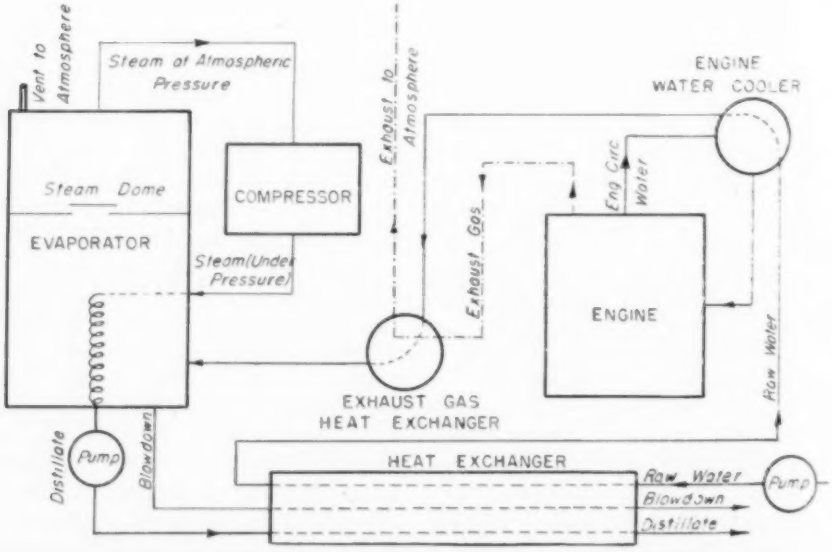

FIGURE 3—Flow Diagram of a Thermocompression Type Distillation Unit

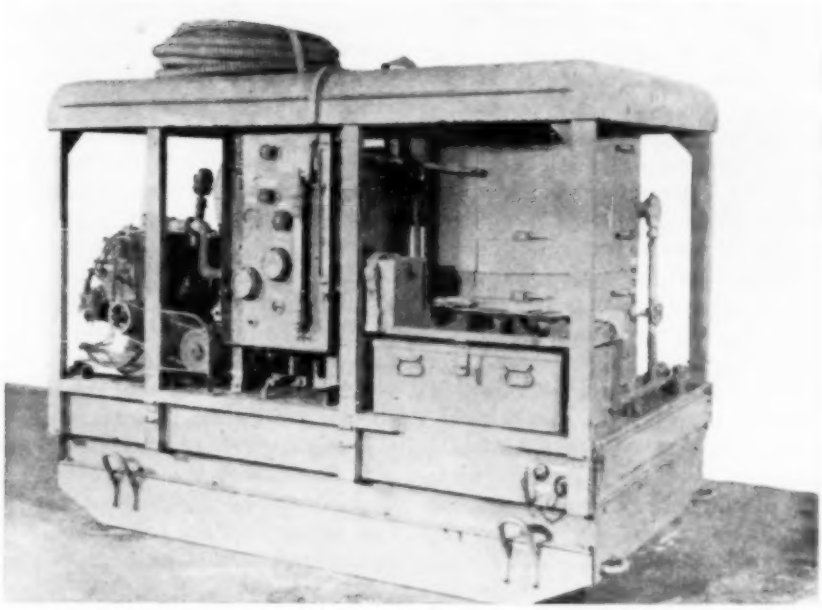

FIGURE 4—Thermocompression Water Distillation Unit

evaporator where it is converted into steam. This steam is compressed, thereby causing temperature rise. The compressed steam is returned to the condenser section of the evaporator, which surrounds the boiling section, where it is condensed, giving up its latent heat, thereby evaporating additional raw water. The operation is continuous, a small amount of brine being continuously discharged to waste through the heat exchanger system. Figures 3 and 4 illustrate the principle of thermocompression distillation.

Compression type distillation equipment is capable of producing well in excess of 100 lb. of distilled water per lb. of fuel consumed in the power unit. Recent design has substantially increased economies now realized. Compression distillation equipment is somewhat more complicated than direct oil-fired equipment, requiring a highly skilled operator, but once the equipment is in operation it requires no more attention than the less economical equipment.

Considering the magnitude of the supply problem, the importance in attaining maximum economy cannot be overemphasized. There is every indication that compression type distillation equipment is the ultimate in distillation. It is evident that this problem offers a most promising field for continued research. Recent technological development in sea water distillation has made available equipment which should have numerous industrial applications during the post-war period.

ION EXCHANGE

The development of modern ion exchange materials has made possible the design and construction of water desalting equipment which removes ionizable salts from water without the introduction of by-products by a process which in operation is comparable to filtration.

These desalting systems generally

consist of two units; the first, a bed of a material having the property of removing cations from solution by exchanging hydrogen ions for the sodium, calcium, magnesium, or other bases present in the water; and the second unit, a bed of an anion-active material that removes the mineral acids which the cation removal agents sets free by exchange of these acids with hydroxyl ions. When influent waters containing several thousand p.p.m. of salts are treated in this way, the results are unsatisfactory.

A desalting system has been developed commercially for brackish waters having total dissolved solids concentration as high as 7,500 p.p.m. This system produces effluent water which is substantially neutral. The system consists of four treating units operated in series. The first unit, as in the conventional process, consists of a cation-active material operating in the hydrogen cycle; the second unit, an anion-active material activated with a strong base; the third, a cation-active material also operating in the hydrogen cycle; and the fourth, an anion remover which has been so treated during activation or regeneration that its effluent is substantially neutral.

In this system, the fourth bed is regenerated with sodium bicarbonate solution, so that the bed is what is called bicarbonate activated to distinguish it from a soda ash or caustic soda activated bed, which is said to be hydroxyl activated. The second cation removes additional quantities of sodium ion both free and combined and it delivers to the fourth bed an influent which is acidic. When this acidic influent reaches the anion bed, the fixed mineral acids are removed and the free sodium ions, formed by splitting of neutral salts, are neutralized by the bicarbonate ion set free in the bed.

The advantages of such a system are: first, a capacity for ion removal of both the cation and anion units is definitely increased, as the first cation and first anion beds can be operated far past initial breakthrough of salt; second, rinse water losses are extremely low, as no water is wasted in washing the last traces of salt from the beds; and third, the effluent is practically neutral, or slightly acidic, due to the presence of carbonic acid.

An ion exchange unit designed in accordance with the principles described above, and as a mobile unit, has been constructed and is under service test. This investigation is intended to show the military utility of this process and to determine its feasibility for both field and fixed installations. Although the military value of this improved ion exchange process remains to be proved, its potentialities are apparent.

PROTECTIVE COATING SYSTEMS

Studies pertaining to corrosion control of metal water tanks have resulted in development of protective coating systems which will satisfactorily withstand water immersion. Valuable assistance in this work was received from the Technical Advisory Committee, Federation of Paint and Varnish Production Clubs. Considering that corrosion is a universal problem, it is believed that the results of this work may have general application.

It is of paramount importance that metal surfaces be clean and free of all scale and rust prior to painting. Sandblasting is the preferable method of surface preparation. Satisfactory results may be expected using 6 lb. of Ottawa sand per sq. ft. of surface at 100 lb. per sq. in. pressure. In addition to cleaning the surface effectively, the sandblast provides an excellent " tooth " for the paint film to adhere to.

Wire brushing may be used for surface preparation in lieu of sandblasting, but vigorous rubbing of the surface

with suitable abrasives is required. Following brushing, the surface is further cleaned with naphtha or turpentine for removal of grease and oils. Phosphate treatment of the cleaned surface is recommended. This consists of applying a 5 per cent phosphoric acid solution and allowing it to dry for one hour after which the surface is washed with warm water and thoroughly dried before painting.

A number of anti-corrosive materials were investigated and tested resulting in the conclusion that synthetic resinous compounds were best suited for use on truck and trailer-mounted metal water tanks. The phenolic, vinyl, and alkyd synthetic resins were thoroughly investigated and the phenolic resins in the unmodified form were found to possess the most satisfactory properties for this purpose.

The 100 per cent phenolic thermosetting resin, due to its heat-reactive property or tendency to polymerize into an infusible and insoluble condition when heated, was superior to other organic coatings tested. Five coats of this material are recommended, which give a film approximately six mils in thickness. Each coat is cured with hot air, the curing schedule varying from 200° F. for 30 minutes on the first coat to 375° F. for six hours as the final bake. Methods used in curing this type resin are important in that temperature may be regulated to control flexibility and impermeability of the finished coating. Corps of Engineers *Specification No. T-1690,* entitled "Protective Coating System for the Interior of Potable Water Tanks," gives details of this system.

Inasmuch as facilities are not always available for application of the thermosetting, phenol-formaldehyde type coating, there was a need for an air drying coating system. Two types of paint were developed for this purpose which make use of unmodified, oil soluble varnish resins. These are considered as alternates to the phenolic thermosetting coating. These two types are described in Corps of Engineers *Specification No. T-1715A* designated as "Protective Coating Materials and Application for the Interior of Potable Water Tanks."

Type I paint is an air drying coating which is pigmented with zinc dust and zinc oxide, 75 per cent by weight. The vehicle is of the unmodified para-phenyl-phenol-formaldehyde resin in linseed oil, having a 25 gal. oil length. The second type air drying paint contains 35 per cent iron oxide pigment by weight. The vehicle for Type II has a 25 gal. oil length and consists of the unmodified para-phenyl-phenol-formaldehyde resin in china wood oil.

The exceptional inhibiting properties of the zinc dust-zinc oxide paint and the covering properties of the iron oxide paint place these two materials among the best air dried protective coating systems tested. They possess the advantages of application by either brush or spray over a surface treated by wire brushing and they are readily cured by natural ventilation when time permits.

TREATMENT OF WATER CONTAMINATED WITH TOXIC MATERIALS

Possible denial of field water supplies through their contamination with toxic materials has long been a source of concern to the responsible agencies. That the situation has never really arisen makes the problem only more complex since it must be handled entirely on a speculative basis, theorizing such matters as possible contaminants, amounts expected, and practicality of treatment. Yet insurance measures against this potential danger cannot be neglected. Recent trends in warfare, such as the attention given reservoirs in Hong Kong and in the Ruhr district of Germany, coupled with the widespread use of non-toxic but nauseating bone-oil to

invalidate precious water points in the Tunisian campaign, emphasize the potential part water may play in war.

Consideration given to the development of treatment methods for Army field use must be confined to rational and practical viewpoints. A vast number of poisonous compounds are known, especially in the organic field, but a critical survey of these substances indicates that most could not be successfully employed as water contaminants. Some are not sufficiently soluble to produce toxic effects while others hydrolyze rapidly and become impotent. In the drug field alone, there are scores of poisonous compounds whose production difficulties, cost, and availability preclude their use in quantity. The more important substances remaining after preliminary eliminations include arsenic, cyanides, and the heavy metal salts among the inorganic compounds, and alkaloids, phenols, glucosides, phytotoxins, organic arsenicals, and the chemical warfare agents in the organic field.

The field treatment of water contaminated with toxic materials such as alkaloids, cyanides, inorganic arsenicals, glucosides, and the heavy metal salts is chiefly of academic importance since they would be encountered only in isolated instances of deliberate, premeditated sabotage. Detection alone suffices here, and in place of treatment such supplies would be by-passed in favor of others or water could be hauled in by motor transport from other producing sources in the area. Treatment only becomes necessary when all available sources are contaminated. This might occur if chemical warfare broke out and contamination of watersheds, surface supplies, and small reservoirs resulted from the use of airplane sprays or gas shells disseminated in either dust or liquid form.

The non-persistent chemical warfare agents present no great danger to water supplies, nor do the irritant smokes which contain arsenic but are difficultly soluble in water. Of chief concern are the vesicant agents toxic in water whose persistency could effect contamination of watersheds: Lewisite, sulfur mustard, and the nitrogen mustards. Also, a retreating army forced to abandon stores of these agents might still make effective use of them by jettisoning them in water supplies.

Much work has been done during the past few years investigating the removal of different toxic materials from water. For Army use a simple universal method is required, it being impractical to adopt several specific treatment processes for use with individual contaminants. Standard water works procedures alone are of value here, and throughout past work activated carbon has received the preferential consideration for this purpose. Activated carbon will adsorb toxic organic contaminants from water although it is not effective in the removal of inorganic cyanides, arsenic, or heavy metals. These, however, were discounted from consideration on other grounds.

The carbon treatment of contaminated water is not ideal, requiring as it does large amounts of carbon. It has, however, the virtues of simplicity, effectiveness with the most probable contaminants, and familiarity to water personnel. Recent work on water treatment at the Engineer Board has been devoted to evaluation of the commercial carbons in order to select the best all-round ones for treatment purposes. Many types of activated carbons are produced commercially for different uses, exhibiting high specificities which cause a wide variance in their removals of different materials. Of these only the finely ground grades are applicable to existing water supply equipment. Thirty-four of these carbons were evaluated against the most probable toxic contaminants, Lewisite,

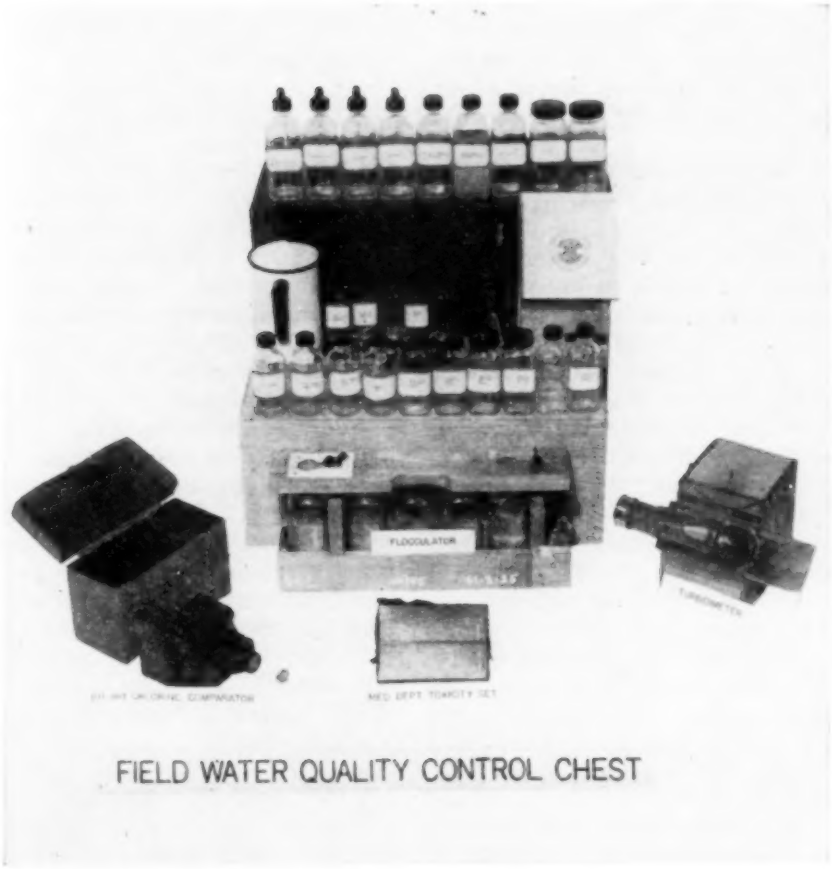

FIGURE 5—Field Water Quality Control Chest

Levinstein mustard, and nitrogen mustards. Results showed a wide range of effectiveness, with only a few outstanding carbons. From the adsorption isotherms developed through the laboratory evaluations, the parts per million required of the best carbon to remove each part per million of agent present, above the potable limit, were found to vary from 10:1 for Lewisite to 90:1 for nitrogen mustards.

It will be evident that the importance attached to treatment of water for removal of chemical agents will be dependent on future trends of the war. The results of work described herein, together with other studies not mentioned, afford protection against the contamination of drinking water sources resulting from chemical warfare.

PORTABLE LABORATORY FACILITIES

Routine control tests are invaluable to the operators of Army mobile and portable water purification equipment. These tests, of course, serve the same purpose with portable equipment as they do in fixed installations. However, authentic information regarding pollution sources is seldom available to personnel charged with the responsibility of operating Army water purification

equipment. Special significance is attached to control tests, and it is imperative that the operator have available means for measuring the efficacy of treatment.

A field water quality control chest, Figure 5, has been developed which is compact and relatively light. Facilities provided in this field laboratory are adequate for routine work and include specific tests for use under certain field conditions. Analytical procedures are essentially as recommended in *Standard Methods of Water Analysis*.

Design of this chest has taken into consideration the highly variable conditions experienced in a theater of operations. Tests are provided which will give a true measure of the performance of the equipment and a prompt appraisal of the quality of the finished water. This laboratory equipment makes possible technical control of the water treatment process. This control, together with constant vigilance in the inspection of the equipment and the water supply source, make possible efficient operation.

SUMMARY

The ramifications of world-wide water supply problems are almost endless. An attempt has been made to portray typical problems of Army water supply and developments resulting therefrom. Each development described is the answer to a definite need. Under duress of war every progressive idea, whose apparent worth stands the test of complete analysis, is given consideration in consonance with its potential value. This liberal attitude promotes rapid advancement not possible in peacetime. Many developments evolving from study of water treatment requirements in various parts of the world may well find application in American water works practice. The challenge of Army water purification problems of World War II invites continued support of technologists in public health.

Nutritive Value of Brined and Fermented Vegetables*

IVAN D. JONES, PH.D., AND JOHN L. ETCHELLS, PH.D.

North Carolina Agricultural Experiment Station; and Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture, Raleigh, N. C.

THE urgency of the food production and preservation program which has faced this nation for the past year cannot be overemphasized. This critical food problem still remains unsolved. To assist in meeting the challenge presented, research men and commercial food processors alike are investigating the possibilities offered by all methods of food preservation.

The salting or brining of food is one of the oldest preservation methods practised by man. Today we recognize that this method still offers tremendous possibilities both for commercial and home preservation of many foods.

An adequate study of the nutritive value of foods preserved by any method should properly include a comparison of the nutritive quality of the processed foods with that of the fresh produce before processing. Generally speaking, a loss in nutrients takes place whenever food is processed whether such treatment be for the purpose of preservation or for cooking for table use. Such loss is dependent upon the products receiving treatment, the processing treatments given, and the care exercised during processing.

The nutrient constituents of a food deserving consideration in a preservation study include carbohydrates, proteins, minerals, and vitamins. There may be a loss of these constituents during food processing either through solution or leaching out of soluble constituents, or through destruction due to chemical changes during processing and storage. Also, since the brining process involves preservation as a result of, or accompanied by, microbiological activity, nutrients may be lost through utilization by microörganisms.

Throughout this discussion the term "brining" will be used whenever reference is made to the preservation of vegetables either through the use of solid salt or through the use of salt brines. Actually, in the preservation of vegetables by this method, the preservation action takes place in brine. The brine may be added as a solution of common salt or it may be formed as the result of the dissolving of solid salt in water withdrawn from the vegetables.

In this connection there seems to be a common belief that brining or salting may be done in such a manner that fermentation either will or will not take place depending upon the exact procedure followed. However, reports by the authors [1, 2] indicate that, throughout the range of brine strength employed in vegetable preservation (upwards of 90 per cent saturation), certain types of salt-tolerant microörgan-

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isms are able to grow and contribute to the general fermentation.

Hence, we consider that a distinction cannot be made between brining procedures strictly on a basis that they will either permit or prevent microbiological activity (fermentation) as the result of such treatments.

The brining of vegetables is an established part of the pickle manufacturing industry. Included among those vegetables so preserved are cucumbers, onions, peppers, tomatoes, and cauliflower. These brined vegetables receive a desalting treatment prior to manufacture into the finished pickle products. Such products have a definite place in our diet but represent a small part of the total food consumed.

The brine preservation of vegetables which can be consumed as non-pickle products, and which can contribute greatly to the food value of our diet offers a distinct possibility for both commercial and domestic-scale production. Vegetables which have been brined for use as non-pickle products include beets, carrots, celery, cauliflower, cabbage, okra, snap beans, green peas, lima beans, greens, and corn. These are important sources of proteins, starch, minerals, and vitamins in the diet.

The salt concentration employed in brining varies from 2½ to 25 per cent by weight, depending upon the vegetable receiving treatment. Sauerkraut from cabbage, or a similar product made from lettuce, turnips, or rutabagas, contains from 2 to 2½ per cent salt. Snapbeans preserved in a low-salt brine contain 5 per cent salt. These products are used in the diet directly without desalting.

Green peas, lima beans, corn, and similar vegetables are generally preserved by the use of either strong brines or large amounts of salt (15 to 25 per cent). In commercial practice snapbeans are mixed with 20 per cent solid salt. With such vegetables it is necessary to reduce the salt concentration materially before they are edible. The reduction in saltiness may be brought about in two ways: Either by the use of a small amount of the salted material in a large volume of soup or a similar preparation; or by soaking in a suitable volume of fresh water before preparing for table use.

The domestic brining of vegetables has been recommended over a period of years by several investigators [3-7] and by the Agricultural Extension Service in many states. Although this method has been repeatedly employed for food preservation, there have been very few reports concerning the nutritive value of such food.

Losses in nutritive constituents may occur, during preservation by brining in the following phases of the process: (1) during preparaton, such as peeling, slicing, or shelling, due to oxidation; (2) during blanching, as the result of leaching; (3) during fermentation as the result of microbiological activity; (4) during the curing and storage period through leaching or through chemical destruction; and (5) during desalting, largely as the result of leaching.

In general, in the brining of vegetables, the soluble carbohydrates or sugars are reduced to a low concentration either during the preservation process, or subsequently during desalting, if the latter process is required.

Brining procedures which are based on the preservation of vegetables at low or moderate salt concentrations (2½ to 10 per cent salt by weight) will be responsible for the complete destruction of the sugars present. This destruction occurs due to the utilization of the sugars by salt-tolerant microörganisms. Brining treatments utilizing high salt concentrations (15 to 25 per cent salt by weight) retard, but do not necessarily prevent, microbiological ac-

TABLE 1

Effect of Brining Treatments on the Protein Content of Certain Vegetables

Vegetables	Pre-brining Treatment	Brining Treatment Vegetables Covered with Brine of Strength Listed	Desalting Treatment	Protein Content Expressed as Percentage of Edible Substance: Preserved Material	Protein Content Expressed as Percentage of Edible Substance: Fresh Material	Protein Retention Per cent
Snap beans	Blanched 2 min. in boiling water	5% salt + vinegar	None	1.14	1.21*	94
Snap beans	None	"	"	0.88	1.86	47
Snap beans	"	15% salt	24 hrs.†	0.67	2.4‡	28
Lima beans (green)	"	"	"	4.85	7.5‡	65
Peas (green)	"	"	"	5.79	6.7‡	86

* Represents the protein value after blanching; initial fresh value was 1.86 per cent
† 1 lb. brined vegetables in 1 gal. water
‡ Data by Chatfield and Adams [11]

tivity.[8, 9, 1] Vegetables preserved by such brining treatments may lose only a portion of their original sugar content during the preservation process. Fabian and Blum [9] have demonstrated, qualitatively, the presence of appreciable quantities of sugar in corn preserved in brines containing 15 and 20 per cent salt and in peas preserved in brine containing 20 per cent salt after a 6 month storage period. If the brined product is used in the diet in soups or in a similar manner not requiring desalting, the remaining sugar will not be lost. Desalting will effectively reduce the sugar concentration to a very low level irrespective of the amount of sugar which may remain at the end of the fermentation process.

The fate of starch during brine preservation has not, to our knowledge, been reported in the literature. Qualitative tests by the authors demonstrated that starch was present in brined snap beans, lima beans, and peas after a 15 month storage period. This is significant in view of the fact that snap beans, immature corn, peas, and lima beans contain appreciable quantities of starch.[11]

Certain proteins are water- and brine-soluble. These may be lost during hot water blanching, by draining away with the brine, or by desalting if these operations are followed. Also a portion of the protein fraction is utilized by the microörganisms associated with brine fermentations.

Relative to actual losses of protein during brining, there is but limited information reported. The protein content of cabbage and sauerkraut is reported as essentially the same in the tables prepared by Chatfield and Adams.[11] This should be the case provided there has been neither a loss of kraut juice nor a replacement of the juice with a fresh brine.

Table 1 lists the protein content of snap beans, and immature lima beans and peas in studies conducted by the authors. In every case a loss in protein has accompanied the brining operation. The extent of loss appears to vary with the kind of vegetables brined. Also, the short blanch given snap beans materially prevented protein loss with this vegetable.

These data further indicate that, in spite of the possibilities of loss in brining as pointed out above, brine-preserved vegetables when prepared for table use showed a marked retention of protein. The retention varied from a high of 94 and 86 per cent for blanched snap beans and unblanched peas respectively, to a low of 28 per cent for unblanched snap beans from a strong

brine. Attention is called to the fact that a 35 per cent loss resulted from the blanching treatment given the fresh snap beans. Subsequent loss of protein during the actual preservation and storage in brine was very small, as has been previously indicated. Due to the fact that the protein values for the fresh vegetables were not determined, the retention figures for the last three vegetables listed in Table 1 were estimated using the protein values for fresh material reported by Chatfield and Adams.[11]

The soluble minerals may be lost during the blanching, brining, or desalting operations. Commercial sodium chloride, however, carries a significant amount of impurities. Due to the quantity of salt employed in the preservation process, there may actually be an increase in the amount of certain mineral constituents other than salt as a result of brining. Peterson, Elvehjem, and Jamison[12] reported an increase of nearly 50 per cent in the iron content of sauerkraut as compared with the cabbage from which it was made.

The calcium content of brined snap beans, lima beans, and peas in studies conducted by the authors is listed in Table 2. A comparison of the brined with the fresh vegetable is not possible in all cases due to the fact that analyses for the mineral content were not made for all of the lots of fresh vegetables. Included in this table for comparison are values for the calcium content of these vegetables as listed in a table by Bridges and Mattice[13] of the mineral content of fresh vegetables. The data presented are interpreted as indicating that the calcium content of brine-preserved foods may be distinctly greater than that of the fresh vegetables which received treatment.

The influence of various food preservation methods on vitamin retention has recently received a great deal of study. Two of the vitamins, namely carotene (pro-vitamin A) and ascorbic acid (vitamin C), have received particular attention relative to their behavior during the treatments involved in food preservation. Carotene is water-insoluble, and although it may be destroyed by oxidation, it is comparatively stable. Ascorbic acid (vitamin C) is water-soluble and is rapidly destroyed by oxidation, especially enzymatically. It is also readily lost by diffusion into water or liquors employed during preservation and processing.

With reference to the behavior of carotene during the preserving of

TABLE 2

Effect of Brining Treatments on the Calcium Content of Certain Vegetables

Vegetables	*Pre-brining Treatment*	*Brining Treatment Vegetables Covered with Brine of Strength Listed*	*Desalting Treatment*	*Calcium Content Expressed as Milligrams of Calcium per 100 Grams of Edible Substance*		*Change Induced by the Treatments Per cent*
				Preserved Material	*Fresh Material*	
Snap beans	Blanched 2 min. in boiling water	5% salt + vinegar	None	24	28*	33 gain
Snap beans	None	"	"	19	18	6 gain
Snap beans	"	15% salt	24 hrs.†	30	50‡	40 loss
Lima beans (green)	"	"	"	44	28‡	57 gain
Peas (green)	"	"	"	53	28‡	89 gain

* Represents calcium content after blanching; initial fresh value was 18 mg./100 gm.
† 1 lb. of vegetables in 1 gal. water
‡ Data from Bridges and Mattice[13]

TABLE 3

Influence of Brining Treatment on Carotene Retention in Certain Vegetables (After Etchells, Jones, and Hoffman [2])

Vegetables	*Brining Treatment. Vegetables Covered with Brine of Strength Given*	*Carotene Retention in Per cent*	*Time of Storage in Months*
Lima beans, unshelled, unblanched	Openheaded kegs out of doors 5% brine raised to 15% in 5 weeks 10% brine raised to 15% in 5 weeks 15% brine held at 15%	Distinctly under 50	4
Peas, unshelled, unblanched	As for lima beans	50	4
Snap beans, unblanched	As for lima beans	Distinctly under 50	4
Snap beans, blanched and unblanched	Closed kegs 4.5% brine plus vinegar. Held at 4.5%	90–95	10
Snap beans, blanched	Closed 1 quart jars 2.5, 5, 10 and 15% dry salt, no brine added	60	5
Leafy Vegetables— Kale, turnip greens and mustard greens, unblanched	Closed 1 quart jars 6.2% brine plus vinegar. Held at 6.2%	50	4–5
Carrots, blanched and unblanched	Closed 2 quart jars 6.2% brine plus vinegar. Held at 6.2%	Little or no loss	6

foods by brining there is but limited information available. Richardson, Mayfield, and Davis [14] reported that the vitamin A content of sweet corn preserved by salting (1 part salt to 7 parts corn by weight) and subsequently desalted and cooked was the same as raw, frozen corn. Furthermore, they found that sweet corn preserved by a brine acidified with vinegar and containing a low salt concentration possessed almost twice the vitamin A content of the raw, frozen corn taken as a basis of comparison.

Etchells and Jones [15] and Etchells, Jones, and Hoffman [2] reported studies on changes in carotene content during the brining of blanched and unblanched snap beans; unshelled lima beans and peas; unblanched leafy vegetables such as kale, mustard greens, and turnip greens; and blanched and unblanched carrots. These data have been summarized in Table 3. The results indicate that carotene losses vary markedly with the vegetable receiving treatment. Under the conditions of the experiments, carrots showed little or no loss of carotene, while lima beans and snap beans, brined and stored in openheaded kegs exhibited a loss of more than 50 per cent. In addition, the results indicated that the brining treatment greatly influenced vitamin retention. Snap beans brined and stored in tightly headed kegs which were filled with an acidified, low salt content brine retained from 90 to 95 per cent of their original carotene content during 7 month storage period in brine.

Blum and Fabian [16] have recently reported changes in carotene content of blanched and unblanched peas, snap beans, corn, and lima beans, preserved mainly with brines of high salt content over a storage period of from 6 to 9 months. The vegetables were brined in 5 and 10 gallon open crocks stored indoors. These investigators summarized their studies in part as follows: " (1) The lower the salt concentration the greater the loss in carotene. . . . (2) Vegetables that were blanched and then salted lost more carotene . . . than did unblanched salted

vegetables. (3) Vegetables differed in their ability to retain carotene . . . during fermentation and storage." These investigators also reported a carotene loss ranging from 2 to 17 per cent during the freshening of brined vegetables (peas, string beans, lima beans, and corn) taken from brines of high salt content. Whether this loss was real or apparent cannot be determined since the relative changes in weights of the material upon desalting were not reported.

By way of summarization of the data which has been reported on carotene losses the following observations seem justified. The loss is determined to a great extent by the vegetable under treatment and the brining method employed. Blanching of the vegetable prior to brining does not appear to favor carotene retention. Treatments employing the use of acidified brines appear to favor carotene retention materially in the preservation of snap beans; however, with vegetables such as carrots or leafy greens, such benefits have not been observed.

As mentioned earlier, ascorbic acid is water-soluble and, furthermore, it is readily oxidized, especially in non-acid media. Many vegetable tissues possess enzyme systems responsible for the rapid destruction of this vitamin.

Pederson, Mack, and Athawes,[17] after a detailed study of changes in the vitamin C content of sauerkraut during commercial manufacture arrived at the following conclusions: Raw kraut (solids plus juice) during and immediately after fermentation in large vats contains approximately the same amount of vitamin C as the original cabbage. During storage in vats after the fermentation, the vitamin C content slowly decreases. This loss in vitamin C appears to be associated with the loss of an atmosphere of carbon dioxide. Canned kraut contained only from 25 to 50 per cent as much vitamin C as freshly made kraut. This loss occurs during the processing of the kraut at the time of canning and does not continue during storage after canning.

Studies by Blum and Fabian[15] and Etchells, Jones, and Hoffman[14] on the brining of snap beans, peas, lima beans, and corn indicate that with these vegetables vitamin C is practically entirely lost. This loss occurs during the fermentation and storage period or during the desalting required to make the product edible, providing it has been preserved by the use of a large amount of salt.

As a part of our current investigations, cauliflower was brined according to several treatments as outlined in Table 4. After a storage period of nearly 7 months, the observed changes in the total ascorbic acid content of the brined cauliflower (vegetable plus brine) can be summarized as follows: Cauliflower preserved in acidified

TABLE 4

Ascorbic Acid Content of Cauliflower Brined According to Several Treatments (After 7 Months' Storage in Brine in Closed Containers)

Material	*Pre brining Treatment*	*Brining Treatment* *	*Ascorbic Acid Content*
Fresh Cauliflower	None	None	67 mg./100 gm.
Brined "	Not blanched	5% brine only	1% retention
Brined "	" "	5% brine + vinegar †	58% "
Brined "	" "	5% brine + lactic acid †	62% "
Brined "	Blanched	5% brine only	24% "
Brined "	"	5% brine + vinegar †	42% "
Brined "	"	5% brine + lactic acid †	50% "

* Vegetable covered with brine containing 5% salt and acid as shown. No additional salt added.
† Initial brine acidity approximately 0.5 per cent when calculated as lactic acid.

brines showed an approximate retention of 60 per cent for the unblanched, and 46 per cent for the blanched lots. On the other hand, cauliflower preserved in non-acidified brines showed a retention of less than 1 per cent for the unblanched, and 24 per cent for blanched lots. This experiment is a striking example of marked ascorbic acid retention obtained by particular brining methods. Substantial ascorbic acid retention was obtained not only on a percentage basis but also on a quantitative basis. The unbrined cauliflower possessed an ascorbic acid content of 67 mg. per 100 gm. and after 210 days' storage in brine, the acidified lots still retained approximately 60 per cent of that amount (based on the total ascorbic acid present in the vegetable and brine).

There is little published information regarding the effect of brine preservation on vegetables in relation to retention of B vitamins. Richardson, Mayfield, and Davis [12] found that corn preserved by salting, after desalting and cooking contained about one-fourth the vitamin B_1 content of raw, frozen corn. Preliminary work by the authors under way at this time on the riboflavin content of peas and snap beans, preserved according to a variety of brining and salting treatments, indicates that an appreciable amount of this vitamin is retained by these vegetables.

CONCLUSION

In conclusion it should be pointed out that the use of vegetables, which have been preserved in strong brines, in a manner not requiring desalting will result in the greatest conservation of nutrient constituents. This can be accomplished through the use of the brined material in the preparation of soups or certain vegetable mixtures.

In the absence of desalting, the total protein retention is high, and mineral losses are small; carotene retention is fair and thiamin and riboflavin may be present in significant amounts. The sugars and ascorbic acid are generally lost during the fermentation period and during brine storage.

When desalting is practised in the preparation of brined foods for table use, somewhat greater losses in protein and minerals may be encountered. The desalting operation will effectively reduce the concentration of the sugars, ascorbic acid, and probably the B vitamins to a very low level. Such losses will be in keeping with degree of dilution required adequately to reduce the salt content.

It has been shown that certain vegetables which are important sources of proteins, starches, and minerals, are well adapted to brine preservation and can be used as non-pickle products. Furthermore, the data presented show that these constituents may be well retained in such brine preserved vegetables. Accordingly, at this time of acute shortages in food supplies, of limitations in labor, transportation facilities, and food processing equipment, it behooves us to give serious consideration to the possibilities of food preservation offered by the brining method.

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The Workshop Faculty includes Ruth E. Grout, Ph.D., Harold H. Walker, Ph.D., Eva G. Donelson, Ph.D., Ruth B. Freeman, R.N., Helen M. Starr, Donald A. Dukelow, M.D., and Harold K. Jack.

Registration procedure, fees and information with regard to working or living facilities can be obtained from Ruth E. Grout, Ph.D., Associate Professor, College of Education and School of Public Health, 121 Millard Hall, University of Minnesota, Minneapolis 14, Minn.

Factors Affecting Germicidal Efficiency of Chlorine and Chloramine*

CAPTAIN GEORGE R. WEBER, SN.C., AND
LIEUTENANT COLONEL MAX LEVINE, SN.C., F.A.P.H.A.

Sanitary Corps, Army of the United States, Station Hospital, Fort Belvoir, Va.; and Brooke General Hospital, Fort Sam Houston, Tex.

REPORTS in the literature disclose a marked divergence of opinion on the relative germicidal efficiency of chlorine and chloramine. Rideal (1910) observed that when an equivalent of NH_3 was added to sodium hypochlorite (1 per cent available chlorine) made by electrolysis, the phenol coefficient rose from approximately 2 for the hypochlorite to 6 for the ammoniated solution (chloramine). It should be noted that the solutions employed were distinctly alkaline.

During World War I difficulties in obtaining an adequate supply of chlorine led Race (1918) to utilize ammonia in conjunction with chlorine for sterilization of the water supply of Ottawa, Canada, with a view to conserving chlorine. He reported experiments in which it was observed that ammoniated bleach solution containing 0.2 p.p.m. available chlorine and 0.1 p.p.m. ammonia was as effective a germicide as was 0.6 p.p.m. available chlorine when employing bleaching powder alone.

Tilley (1920) observed that addition of ammonia to Dakin's solution resulted in an increased germicidal efficiency whereas when ammonia was added to chlorinated water a drop in germicidal properties was effected.

Holwerda (1928) and Gerstein (1931) studying the germicidal efficiency of chlorine-water (with and without addition of ammonia) reported that the germicidal properties were greater when ammonia was not present.

Charlton and Levine (1937) suggested that the conflicting reports in the literature on the germicidal efficiencies of chlorine and ammonia-chlorine (chloramine) solutions might be reconciled if influence of reaction (pH) on the disinfecting properties of these two types of chlorine compounds was taken into consideration.

The objectives of the following brief report are to present data on the relative effects of such factors as (1) presence of ammonia, (2) reaction (pH), (3) concentration, and (4) temperature, on the germicidal efficiencies of chlorine and chloramine, in the absence of organic matter.

TECHNIC

The test organism employed was a suspension of *Bacillus metiens* spores prepared in the following manner: The growth from 20 day–30° C. agar slant cultures was washed off in Butterfield Formula C water and filtered through Whatman No. 2 filter paper to remove clumps. The filtrate was then heated

* Based on data from laboratories of the Department of Bacteriology and the Engineering Experiment Station, Iowa State College, Ames, Iowa. Presented before the Engineering Section of the American Public Health Association at the Seventy-second Annual Meeting in New York, N. Y., October 13, 1943.

at 80° C. for 10 minutes to destroy vegetative cells. This spore suspension, stored at 5° to 10° C., did not disclose any appreciable change in resistance to chlorine for a period of over a year and therefore lends itself particularly well to comparative studies over a long period of time. Just prior to use a portion of the suspension was diluted to approximately 20 million viable spores per ml.

Previous observations had disclosed that the reaction of alkaline unbuffered chlorine solutions tends to become more acid on exposure to air and stirring. All experiments reported herein were therefore carried out in M/20 concentration of appropriate buffers at desired reactions (pH), which were determined with the glass electrode. All water employed in the following experiments was ammonia-free when tested with Nessler's reagent.

Chlorine solutions were prepared by diluting a saturated stock solution made by passing gaseous chlorine into ammonia-free water. This saturated chlorine was kept in a glass stoppered bottle painted black on the outside and stored in a refrigerator at approximately 10° C. Under these conditions the chlorine content was found to remain quite constant. Ammonium sulfate was the source of ammonia, but all computations are made as NH_3.

The procedure for determining germicidal efficiency was briefly as follows:

To 75 ml. of an appropriately buffered solution, containing a desired concentration of NH_3, was added 25 ml. of chlorinated water containing the desired concentration of chlorine, and the flask containing the mixture was placed in a water bath. One ml. of the spore suspension (diluted so as to contain about 20 million viable cells per ml.) was placed into 100 ml. of the test solution which was being constantly stirred. (This would yield an initial inoculum of one million viable cells per 5.0 ml. of the test solution. The number of viable spores was determined by plating a portion of the spore suspension on nutrient agar.) At the time that the spore suspension was introduced into the disinfecting mixture, the concentration of available chlorine was determined for a duplicate sample by titration with sodium thiosulfate in acid solution.

At desired time intervals, 5 ml. portions were withdrawn and placed in 45 ml. of sterile water containing sufficient sodium-thiosulfate to neutralize any residual chlorine, and the number of surviving bacteria was ascertained by plating on nutrient agar (24 hour 30° C.).

Curves were then made by plotting the logarithms of the percentage of survivors against the period of exposure in minutes, and the time for effecting a reduction of 99 per cent of the exposed spores was read from the curves and designated as the killing time (K.T.).

The question might readily be raised as to why spores were used and whether the results are applicable to water sterilization. With reference to the first question, it might be pointed out that chlorine is so effective a germicide that when employing vegetative cells the rate of death is so high (and the concentrations of chlorine employed necessarily being very low and therefore subject to wide errors in determination as well as to combination with traces of such compounds of ammonia which might inadvertedly be present), that observations on rates of death and the effects of variations in temperature and reaction or concentration on these rates would be extremely difficult to carry out.

In contrast to this, by utilizing spores, it is feasible to employ high concentrations of chlorine which would not be affected appreciably by traces of impurities; studies over a wide range

of reaction, concentration, and temperature, are possible and the rates of death are sufficiently low so that patterns of the survivor curves may be readily observed. Furthermore, it is very difficult to obtain vegetative cells of uniform resistance; whereas the spore suspension employed was found to be strikingly uniform in resistance to chlorination and could therefore be employed over a long period of time for comparative studies.

As to the question whether the results with spores would be indicative of what might be expected with vegetative cells, it might be pointed out that survivor curves obtained by the authors for spores exposed to chlorine and chloramine were later confirmed by Schmelkes for *Escherichia coli* and that the relative efficiency of chlorine and chloramine reported for spores was recently found to hold for vegetative cells. Thus, Weber, Bender, and Levine (1940) reported that *B. metiens* spores exposed to approximately 22 p.p.m. available chlorine (as hypochlorite) were killed in 3 minutes, whereas it required about 28 times as long (approximately 85 minutes) when the same concentration of available chlorine was employed as chloramine. Streeter (1943) reports a killing time of 2–3 minutes for *E. coli* when employing 0.05 to 0.1 p.p.m. chlorine as compared with 40 to 90 minutes for the same concentration of available chlorine as chloramine. The relative killing times of chlorine as compared with chloramines for spores and vegetative cells, respectively, were therefore quite similar.

SURVIVOR CURVES FOR DISINFECTION WITH CHLORINE AND CHLORAMINE

In Table 1 and Figures 1 and 2 are shown results illustrative of the rates of death of spores exposed to chlorine and chloramine. In survivor curves for disinfection with chlorine, there are exhibited distinct periods of lag in rates of death—very prolonged when employing high alkaline solutions, low temperatures or low concentrations—followed by progressively increasing death rates. Thus, with chlorine at pH 7, 24 per cent of the exposed spores died in the 1st minute, 49 per cent of

TABLE 1

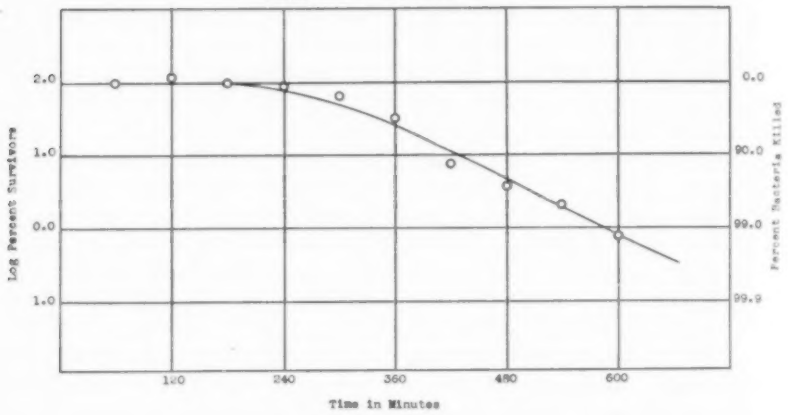
Showing Per cent Reduction of Surviving Bacillus metiens Spores in Consecutive Equal Periods of Exposure to Chlorine and Chloramine at 20° C.

Chlorine			Chloramine		
*Time in Min.**	*Per cent Surv.†*	*Per cent Red.‡*	*Time in Min.**	*Per cent Surv.†*	*Per cent Red.‡*
		pH 10			
0	100	..	0	100	..
60	100	0	30	53	47
120	100	0	60	23	57
180	94	6	90	12	47
240	78	17	120	5.4	58
300	60	23	150	2.9	60
360	29	52	180	1.0	50
420	10	66	210	0.5	50
		pH 7			
0	100	..	0	100	..
1	76	24	20	72	28
2	39	49	40	28	61
3	1.1	97	60	9.8	65
			80	1.7	83
			100	0.6	65

* Period of Exposure (in minutes) to germicide
† Per cent survivors after stipulated periods of exposure
‡ Per cent reduction of survivors in consecutive equal periods of exposure

Fig. 1

RESISTANCE OF B. METIENS SPORES TO CHLORINE AT pH 10.0
(25 p.p.m. Av. Cl.; 20° C.)



those which survived 1 minute died in the 2nd minute, and 97 per cent of the then remaining cells died in the 3rd minute of exposure. In the series with chlorine at pH 10, there was no decrease in bacterial count for 2 hours. This was followed by a progressively increasing rate of death. Thus, during the 3rd hour, only 6 per cent of the survivors after 2 hours were killed; 24 per cent of the spores which survived for 4 hours were killed in the 5th hour; whereas of those which survived 6 hours, 66 per cent were killed during the 7th hour of exposure.

In contrast to these curves of increasing death rates observed with chlorine (Figure 1), disinfection with chloramines discloses but short lags followed by quite constant death rates throughout the period of disinfection, so that the survivor curves are practically straight lines (Figure 2).

EFFECT OF AMMONIA ON CHLORINE RESIDUAL

In Table 2 are shown the residuals remaining 60 minutes after addition of approximately 25 p.p.m. available chlorine to solutions containing various

Fig. 2

RESISTANCE OF B. METIENS SPORES TO CHLORINE AND AMMONIA AT pH 10.0
(25 p.p.m. Av. Cl.; 6 p.p.m. NH_3; 20° C.)

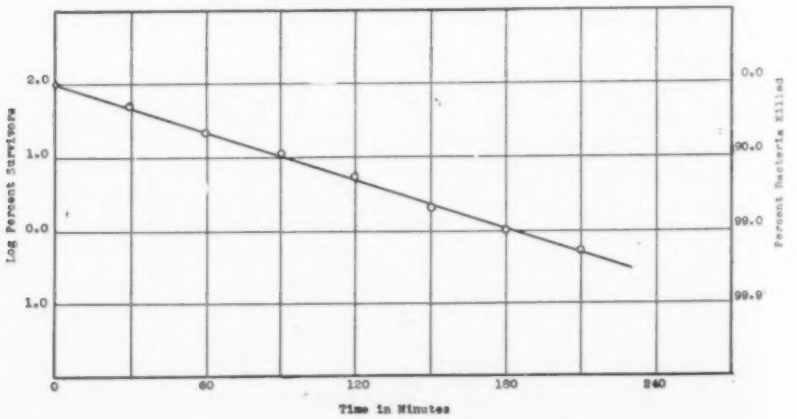


TABLE 2

Effect of Presence of Ammonia on Residual Available Chlorine

Series	Reaction: NH_3 Added (p.p.m.)	Reaction: Cl/NH_3*	pH 5	pH 6	pH 7	pH 8	pH 9	pH 10
			Residual Available Chlorine (p.p.m.) 60 Minutes after Admixture					
A	0.0	....	24.2	23.4	23.2	22.0	24.2	24.2
B	0.5	50/1	21.3	19.8	19.4	18.6	20.4	21.1
C	2.0	12.5/1	10.2	10.8	7.3	7.7	10.9	11.7
D	6.0	4.2/1	22.1	21.8	21.1	19.6	22.6	23.2
E	18.0	1.4/1	23.4	23.4	23.0	21.6	22.9	23.1
			Decrease in Residual Av. Cl. (p.p.m.) Over Series Without Added Ammonia †					
B	0.5	50/1	2.9	3.6	3.8	3.4	3.8	3.1
C	2.0	12.5/1	14.0	12.6	15.9	14.3	13.3	12.5
D	6.0	4.2/1	2.1	1.6	2.1	2.4	1.6	1.0
E	18.0	1.4/1	0.8	0.0	0.2	0.4	1.3	1.1
			Decrease in Residual Av. Cl. (p.p.m.) per p.p.m. Ammonia Added †					
B	0.5	50/1	5.8	7.2	7.6	6.8	7.6	6.2
C	2.0	12.5/1	7.0	6.3	7.9	7.2	6.7	6.3
D	6.0	4.2/1	0.4	0.3	0.4	0.4	0.3	0.2
E	18.0	1.4/1	0.0	0.0	0.0	0.0	0.1	0.1

* Approximate ratio of available chlorine to ammonia on basis that 25 p.p.m. available chlorine had been added

† To nearest 0.1 p.p.m.

concentrations of ammonia (added as ammonium sulfate) and buffered at reactions pH 5 to pH 10. The losses in residual chlorine per p.p.m. ammonia added are also indicated. It will be noted that when the ratio of chlorine to ammonia was high (12.5/1 and 50/1) there was considerable loss of chlorine (approaching about 7.5 p.p.m. chlorine lost per p.p.m. ammonia added) and that this loss was greatest in solutions near the neutral point; but, as the relative concentration of ammonia increased (ratio of chlorine/ammonia = 4.2/1 or less) the loss of chlorine became negligible. In general, if the concentration of NH_3 is less than about one-eighth that of the available chlorine, NH_3 will be oxidized and the chlorine residual (which will be reduced in proportion to the quantity of ammonia present) will consist of hypochlorite. The effect is therefore merely to reduce the concentration of the active germicide but its nature is unaltered. If, however, the concentration of ammonia is more than one-quarter that of available chlorine, then chloramines will be formed and the effect is to change the nature of the germicide, whereas the concentration of available chlorine is only slightly altered. With a chlorine/ammonia ratio of 4.2/1 the available chlorine is presumed to exist as chloramine, the relative concentrations of the mono and dichloramine being a function of the reaction.

EFFECT OF REACTION ON GERMICIDAL EFFICIENCY OF CHLORINE, CHLORAMINE, AND CHLORAMINE WITH EXCESS AMMONIA

Observations were made at reactions of pH 5 to pH 10, employing the following solutions to which were added chlorinated water to yield approximately 25 p.p.m. available chlorine.

Series I. Buffered water (chlorine as hypochlorite)

Series II. Buffered water containing 6 p.p.m. NH_3 (chlorine as chloramine)

Series III. Buffered water containing 18 p.p.m. NH_3 (chloramine with excess NH_3)

The test organism was introduced into the disinfecting solution 15 minutes after addition of chlorine and the temperature was maintained at 20° C.

TABLE 3

Effect of Reaction (pH) on Germicidal Efficiency of Chlorine, Chloramine, Chloramine with Excess Ammonia

(*Bacillus metiens* spores; app. 25 p.p.m. av. cl.; 20° C.)

Reaction			pH 5	pH 6	pH 7	pH 8	pH 9	pH 10
Series	NH_3 Added (p.p.m.)	Cl/NH_3*	Killing Time (in minutes)					
I	0	....	2.1	2.3	3.0	7.6	58.0	570.0
II	6	4.2/1	168.0	85.0	89.0	83.0	182.0	186.0
III	18	1.4/1	99.0	59.0	84.0	107.0	263.0	456.0
Series	NH_3 Added (p.p.m.)	Cl/NH_3	Initial Residual Chlorine †					
I	0	....	24.2	23.4	23.0	22.0	24.2	24.2
II	6	4.2/1	22.6	21.8	23.6	22.0	23.0	23.0
III	18	1.4/1	23.3	23.1	23.4	22.8	22.6	23.0

* See Table 2

† At time of addition of test organism (15 minutes after addition of chlorine)

In Table 3 are shown the initial residual chlorine concentrations (at time of introduction of test organisms) and the killing times (time to kill 99 per cent of the exposed spores).

Comparing Series I (chlorine) with Series II (chloramine), several things are strikingly evident. For chlorine, germicidal efficiency was a direct function of reaction. The killing time varied slightly, from 2.1 minutes at pH 5, to 7.6 minutes at pH 8, thereafter increased very rapidly to 58 minutes at pH 9, and 570 minutes at pH 10.

In marked contrast to this, there was no significant difference in the killing times (83 and 89 minutes) for chloramine (Series II) in the range pH 6 to pH 8, whereas for solutions more acid (pH 5) and more alkaline (pH 9 and pH 10) the killing times (168 and 186 minutes) were approximately double those in the range pH 6 to 8.

The effect of presence of a large excess of ammonia on germicidal efficiency of chloramine may be noted by comparison of Series II and III. At pH 7 the killing times (89 and 84 minutes) were the same within limits of experimental error of determination. Chloramine in the presence of a large excess of ammonia (Series III) was more effective at pH 5 and pH 6 but distinctly less effective as a germicide at pH 9 and pH 10 than was chloramine solution in which there was not present any excess of ammonia.

The data for chlorine (Series I) and the chloramine (Series II and III) are shown graphically in Figure 3 where the logarithms of the killing times are plotted against the reactions (pH). The curves for chlorine and chloramine cross at pH 9.4. At reactions more acid than pH 9.4 chlorine is markedly more effective, whereas at more alkaline reactions chloramine is the more efficient. In this connection it might be pointed out that the increased germicidal effect produced by addition of an equivalent of ammonia to electrolyzed hypochlorite solution, first noted by Rideal (1910), was probably associated with the fact that he was working with sodium hypochlorite which was quite alkaline.

The greater germicidal efficiency of chloramine as compared with hypochlorite at reactions more alkaline than pH 9.4 may be particularly significant in conjunction with chlorination of softened water and water treated by the excess lime process, if reactions of about pH 10 are maintained.

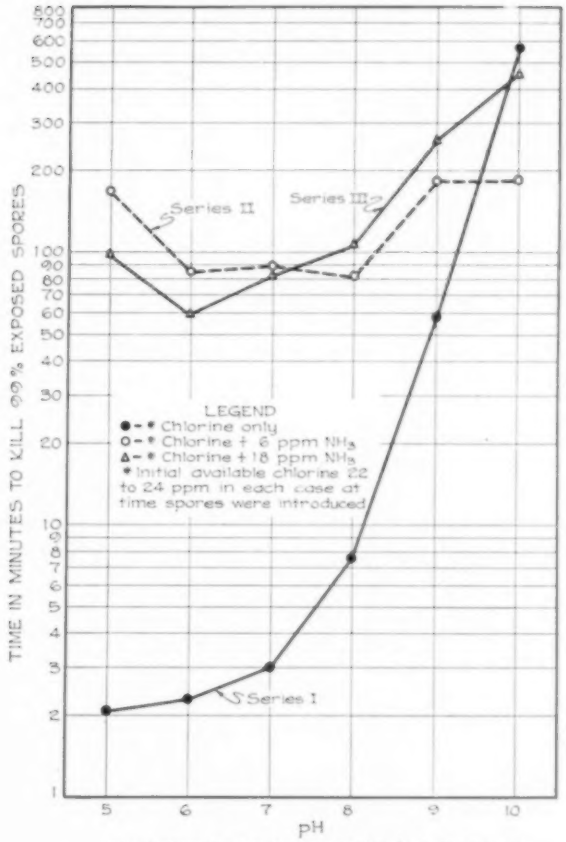

TIME IN MINUTES TO KILL 99% EXPOSED SPORES
pH
Series II
Series III
Series I
LEGEND
● – * Chlorine only
○ – * Chlorine + 6 ppm NH3
△ – * Chlorine + 18 ppm NH3
* Initial available chlorine 22 to 24 ppm in each case at time spores were introduced

FIG. 3 EFFECT OF REACTION (pH) AND AMMONIA ON GERMICIDAL EFFICIENCY OF CHLORINE (20°C)

EFFECT OF CONCENTRATION ON GERMICIDAL EFFICIENCY OF CHLORINE AND CHLORAMINE AT VARIOUS REACTIONS

Killing times for each of four concentrations of chlorine and chloramine were determined for reactions pH 10, pH 7, and pH 5 at a temperature of 20° C. The data are shown in Table 4.

With chlorine, the results were very consistent. They indicated that by doubling the concentration, the time required to kill 99 per cent of the exposed spores was reduced by 45 to 50 per cent or, to put it conversely, as the concentration of available chlorine was cut in half the period of exposure (or killing time) was increased 1.8 to 2.0 fold. This seemed to hold true for each of the reactions under observation.

The results were more erratic with chloramine but indications were that the effect of varying concentration was somewhat less marked than was observed with chlorine and that a reduction of 35 to 40 per cent may be expected on doubling the concentration, i.e., the period of exposure would have to be increased 1.6 to 1.7 fold if the concentration of chloramine were reduced by 50 per cent.

TABLE 4

Relation of Concentration to Germicidal Efficiency of Chlorine and Chloramine

(*Bacillus metiens* spores; app. 25 p.p.m. av. cl.; 20° C.; pH 5, 7 and 10)

Chlorine				*Chloramine*			
Av. Cl.	*"KT" (Min.)* ‡	*Per cent Red.* "KT"*	*Relative† Increase "KT"*	*Av. Cl.*	*"KT" (Min.)* ‡	*Per cent Red.* "KT"*	*Relative† Increase "KT"*
	pH 10				*pH 10*		
24.2	570	..	...	23.0	186	..	...
47.0	291	49	2.0	41.5	95	49	2.0
94.3	170	41	1.7	84.6	60	37	1.6
188.0	98	43	1.8	140.0	51	15	1.2
Average		44	1.8	Average		33	1.6
	pH 7				*pH 7*		
6.3	11.7	..	...	11.3	110	..	...
12.4	5.4	54	2.2	23.6	89	19	1.2
23.0	3.0	45	1.8	44.7	41	53	2.2
48.6	1.4	53	2.1	86.4	27	34	1.5
Average		51	2.0	Average		35	1.6
	pH 5				*pH 5*		
6.3	8.5	..	...	11.4	251	..	...
12.5	3.8	55	2.2	22.6	168	33	1.5
24.2	2.1	45	1.8	44.4	77	53	2.1
49.3	1.2	43	1.8	87.0	47	39	1.6
Average		48	1.9	Average		42	1.7

* Per cent reduction in "KT" effected by approximately doubling concentration av. cl.
† The number of fold increase in "KT" if concentration of available chlorine is approximately halved
‡ "KT" = Killing time, i.e., period of exposure to effect destruction of 99 per cent exposed spores

TABLE 5

Relation of Temperature to Germicidal Efficiency of Chlorine and Chloramine

(*Bacillus metiens* spores; app. 25 p.p.m. av. cl.; pH 5, 7 and 10)

Chlorine					*Chloramine*				
Temp. ° C.	*Av. Cl. (p.p.m.)*	*"KT" Min.‡*	*Per cent Red. "KT"**	*Relative Increase "KT" (Q 10)†*	*Temp. ° C.*	*Av. Cl. (p.p.m.)*	*"KT" Min.‡*	*Per cent Red. "KT"**	*Relative Increase "KT" (Q 10)†*
		pH 10					*pH 10*		
20	24.2	570	..	...	20	23.1	186	..	...
30	23.3	240	58	2.4	30	21.7	46	75	4.2
40	23.2	100	58	2.4	40	22.3	11.2	76	4.2
50	22.8	46	54	2.1	50	20.7	3.3	71	3.4
Average			57	2.3	Average			74	3.9
		pH 7					*pH 7*		
0	24.5	12.9	..	...	20	23.6	89.0	..	...
10	24.2	6.2	52	2.1	30	22.1	29.5	67	3.0
20	23.0	3.0	51	2.1	40	21.3	8.6	71	3.4
30	24.1	1.4	53	2.1	50	19.3	2.9	66	3.0
Average			52	2.1	Average			68	3.1
		pH 5					*pH 5*		
0	24.8	10.0	..	...	20	22.6	168	..	...
10	24.5	4.3	57	2.3	30	21.5	38	77	4.3
20	24.2	2.1	51	2.1	40	20.6	11.3	70	3.4
30	24.1	1.2	43	1.8	50	20.7	3.8	66	3.0
Average			50	2.1	Average			71	3.6

* Per cent reduction in "KT" effected by a rise of 10° C.
† The number of fold increase in "KT" effected by a drop of 10° C.
‡ See Table 4.

EFFECT OF TEMPERATURE ON GERMICIDAL EFFICIENCY OF CHLORINE AND CHLORAMINE AT VARIOUS REACTIONS

Observations on the effect of temperature were made employing approximately 25 p.p.m. available chlorine at reactions pH 10, pH 7, and pH 5. Temperatures of 20°, 30°, 40°, 50° C. were employed for all observations with chloramine and for the chlorine solution at pH 10, but at the more acid reactions, temperatures of 0°, 10°, 20°, and 30° C. were employed for the chlorine series. The data are detailed in Table 5.

Generally speaking, the temperature coefficients seem to be relatively slightly influenced by reaction, but they are significantly different for the two compounds. Thus, with chlorine, a rise of 10° C. effected a reduction of 50 to 60 per cent in the killing time so that for a drop of 10° C. the period of exposure would have to be increased 2.1 to 2.3 fold. With chloramine, on the other hand, a rise of 10° C. is accompanied by a reduction of approximately 68 to 74 per cent in killing time; i.e., a drop of 10° C. entails a 3.1 to 3.8 fold increase in the period of exposure to effect the same bacterial reduction. The practical significance of the foregoing observations might be illustrated by the following example: If a contact period of 30 minutes at 20° C. is considered adequate for safety for a stipulated residual chlorine, the contact period would have to be raised to 60 to 70 minutes if the residual were chlorine (hypochlorite) or to 95 to 115 minutes for a chloramine residual, should the temperature of the water fall to 10° C. If the temperature of the water approached 0° C. then the period of contact for a stipulated chlorine (hypochlorite) residual would have to be increased to 130 to 160 minutes, whereas for a chloramine residual a contact period of 290 to 430 minutes would have to be employed to effect an equivalent germicidal action.

SUMMARY

A technic is described for determining the nature of survivor curves and the time required to effect a reduction of 99 per cent of *Bacillus metiens* spores exposed to chlorine and chloramine at various reactions and temperatures.

On the basis of previous findings and reports in the literature, results obtained with spores are considered applicable to those which might be anticipated for vegetative cells exposed to chlorination.

In disinfection with chlorine there was exhibited a marked lag followed by progressively increasing death rates; whereas with chloramine the rates of death were (except for a short lag) quite constant throughout the period of disinfection.

With concentrations of ammonia less than one-eighth that of available chlorine (hypochlorite) the chlorine residuals were reduced in proportion to the ammonia present but the nature of the germicide remained unchanged (hypochlorite). With concentrations of ammonia greater than one-fourth that of the available chlorine, the concentration of available chlorine was but slightly altered, but the nature of the germicide was changed from hypochlorite to chloramine.

Doubling the concentration of available chlorine reduced the killing time by approximately 50 per cent and 40 per cent for chlorine and chloramine, respectively.

A drop of 10° C. resulted in a twofold increase in the period of exposure when employing chlorine and a 3 to 4 fold increase for chloramine, to effect equivalent germicidal action.

The germicidal efficiency of chloramine was not appreciably affected by the presence of a large excess of ammonia at pH 7, but at more acid reac-

tions its efficiency was greater, whereas at more alkaline reactions the killing power was markedly less than was observed for chloramine alone.

At reactions more acid than pH 9.4 chlorine (hypochlorite) was by far the more efficient germicide, but at more alkaline reactions chloramine was better than chlorine.

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Prescriptions for Heavy Cream to be Approved by Health Officers

The War Food Administration has announced the adoption of measures to prevent the abuse of certain provisions of War Food Order 13 with regard to the prescription of heavy cream for use in the treatment of the sick. On June 2, an amendment to the Order was issued which requires that prescriptions for heavy cream be approved "by the public health officer, or the secretary of the county medical society, of the municipality or county" where the patient or hospital desiring the cream is situated.

Housing Problems of Interest to the Public Health Engineer*

M. ALLEN POND

Sanitary Engineer (R), U. S. Public Health Service, Washington, D. C.

THE Bureau of the Census has reported that there were about 37,325,000 dwelling units in the United States in 1940.[1] Nearly 50 per cent of these were in need of major repairs or lacked inside toilets or baths (Table 1), and 940,000 rural homes had neither a toilet nor a privy. It is evident that a large part of the American public is not served by modern sanitary conveniences.

TABLE 1

Certain Dwelling Unit Characteristics, 1940

	Urban	*Rural* *	*All*
Millions of Units	23.685	13.64	37.325
Millions needing major repairs or lacking inside toilet or bath	7.085	11.139	18.224
Percentage needing major repairs or lacking inside toilet or bath	29.9	81.8	48.8

* Excluding rural units within metropolitan areas

It has been estimated that apart from replacements there is an average annual need for 500,000 new dwelling units in this country. These would be for newly formed families, and to replace structures destroyed by fire or natural phenomena. Furthermore, 10 to 15 million new dwelling units are needed to replace existing substandard housing. Translated into dollars, this means that at least 40 billions would be required to provide necessary new housing. An additional 5 million housing units should be rehabilitated at a cost that probably would exceed 2.5 billion dollars. Colean has estimated that the country could absorb anywhere from 900,000 to 1,200,000 new dwellings a year in the decade following the war and still be in need of a large amount of repair during the same period.[2]

There are essential differences between housing built in a peacetime program, and shelter for war workers. The former is designed to last for relatively long periods of time, most generally from 25 to 60 years. Planning for it can be leisurely in comparison with wartime standards, and careful attention can be paid to all details. War housing, which is admittedly temporary, generally has to be built in the shortest possible time, with the result that every expedient to prevent delay is grasped. Building materials in wartime frequently are on the critical list, and many are not available for housing. Standards for wartime construction are perforce lower than those considered to be minimal in peacetime.

It is the purpose of this discussion to point out some of the phases of any

* Presented before the Engineering Section of the American Public Health Association at the Seventy-second Annual Meeting in New York, N. Y., October 14, 1943.

large scale housing construction and rehabilitation program that should interest public health engineers. Many of the comments stem from the writer's experience during the past eighteen months while he has been detailed by the Public Health Service to be Sanitary Engineer Consultant to the Federal Public Housing Authority.

SANITARY ENGINEERING PROBLEMS

The sanitary engineering problems of housing are essentially those of the community. For this reason it is the policy of FPHA as well as the Federal Housing Administration to use existing public utilities wherever possible. Effective coöperation of these agencies, with the Federal Works Agency and local governments has been instrumental in strengthening the water supply and sewage disposal facilities of many communities. However, the exigency of providing shelter in the shortest possible time has occasionally necessitated the development of on-site water resources or sewage treatment plants. It is with these utilities that health department engineers should have a primary concern.

Reference has been made to the need for rapid development of projects to house war workers. Under the terms of the Lanham Act, the National Housing Administrator is authorized "without regard to . . . any federal, state or municipal laws, ordinances, rules, or regulations relating to plans and specifications or forms of contract, the approval thereof or the submission of estimates therefor . . . to make surveys and investigations, plan, design, construct, remodel, extend, repair, or demolish structures, buildings, improvements and commercial facilities."[3] In order to eliminate all possible sources of delay it has been the policy of the FPHA not to submit plans to state and local authorities for approval. However, the Authority attempts to coöperate closely with all interested state and local officials. In the post-war period, as before the war, public housing will undoubtedly be constructed by local authorities and will conform to all local ordinances and regulations.

WATER SUPPLY

Water is generally provided at large new housing developments for fire fighting purposes, thus assuring a supply that is quantitatively sufficient for domestic purposes. Public health engineers will usually be concerned with questions relating to the safety of the source, the degree of treatment, and the construction and operation of plants and distribution systems, when such facilities are built to serve new housing.

For instance, the FPHA was recently concerned with difficulties in sterilizing water mains at a war trailer project. The supply, taken from a potable source, as it entered the project mains was slightly contaminated. Samples collected from frost-proof hydrants at the extremities of the system showed serious bacteriological contamination. There were no physical evidences of faulty construction, and the system on-site was superchlorinated seven times, with dosages ranging up to 200 p.p.m. of available chlorine. Contact periods exceeded 24 hours. Samples continued to be unsatisfactory. The questions were asked: Should these badly needed trailers be opened for occupancy before there is bacteriological evidence that the water supply is free from contamination? If not, where will the essential war workers in this isolated, crowded community be housed? Is it the state's responsibility to install an emergency chlorinator at this project? Provision was subsequently made for permanent chlorination, thus answering these particular questions. However, they are typical of others that are raised

periodically concerning war housing water supplies.

Arrangements have recently been made with several state health officers to examine water samples collected by FPHA project managers. In at least one state, samples are routinely collected by health department representatives from housing projects served by FPHA-owned water supplies. Do health department engineers regularly arrange for this service for privately built, multiple-unit housing developments served by other than public water supplies?

In some states, builders are required to submit plans for the development of on-site water supply and sewage disposal facilities to the state health department for review and approval before construction begins. This is a desirable practice and should be universal.

SEWAGE AND REFUSE DISPOSAL

Health officials are constantly confronted with problems arising out of the disposal of sewage from dwellings located in areas where sewers are not available and cannot be justified. If housing developers consulted appropriate health authorities when selecting sites *and* if health departments were prepared to review all plans for and supervise the installation of on-site sewage disposal systems, most of these problems would never arise. However, until public health engineering services are more generally provided, it is evident that sewage nuisances will occur frequently. This is particularly noteworthy in light of the sewage disposal needs expressed above.

The collection and disposal of refuse from suburban and small town homes present particular difficulties. It would doubtless be possible to establish satisfactory refuse disposal systems in many places where extensive housing is built, if public health engineers could cooperate with housing officials during the housing development stage as is the case now with FPHA projects. It has been evident in many war-boom areas that the lack of a suitable local catalyst has prevented the crystallization of a refuse disposal system. Conversely, competent local sanitarians have stimulated the organization of satisfactory wastes disposal schemes in several places.

STRUCTURAL PROBLEMS

Outmoded and highly restrictive plumbing legislation may seriously interfere with the extension of decent indoor sanitary facilities to tenants of low rent housing. Connolly has pointed out the important factors to be considered in designing plumbing for low cost housing,[4] and a subcommittee of the now defunct Central Housing Committee has developed a comprehensive plumbing manual for use by federal construction agencies.[5] Plumbing codes generally should be brought up to date, both to protect the public health and to permit uses of materials which will give better and more lasting plumbing. Unless many city plumbing codes are modernized it is likely that progress in providing inside plumbing in the thousands of structures that are otherwise rehabilitable will be seriously impeded if not entirely blocked.

During the present national emergency it has been necessary to lower plumbing standards for temporary housing.[6] However, an attempt was made to preserve those parts of codes devised to protect the public health.

New and existing houses in many American communities should be ratproofed. There is an adequate economic reason for doing this, and in many places the hazard of rodent-borne disease is serious. Private builders probably will not plan for rat proofing if official pressure is not exerted by the health department.

The Royal College of Physicians of London has recently drawn up a memorandum entitled "*Design of Dwelling Houses*" that contains much interesting information concerning desirable structural characteristics for homes.[7] Furthermore, the document reveals the need for intensive research, much of which would involve physical and physiological studies that cannot readily be conducted under state and local health department auspices. However, studies of the technics of housing sanitation might be carried out by engineers attached to such agencies.

APPRAISAL OF URBAN HOUSING NEEDS

Many of the needs for new housing are bound to be met in the post-war decade. The slum clearance and public housing work of the 30's will doubtless be continued with new vigor, as will the extensive private home building program that is so much a part of America. In addition, the elimination of temporary war housing projects will involve considerable work.

It is essential that careful planning for new housing be conducted on federal, regional, and local levels. The National Housing Agency, parent organization of FPHA and FHA, is logically concerned with national planning. Equally responsible for local planning are town, city, and county governments. The time to do that planning is now.

In order to do successful planning, specific data on housing needs should be available.

A useful technic for studying the quality of urban housing, and indirectly the need for new construction and for the rehabilitation, has been developed by the Committee on the Hygiene of Housing of the A.P.H.A.[8] It has been tested in New Haven, Stamford, and Waterbury, Conn., and in Portland, Me., and is ready to be applied elsewhere.

The committee believes that health officers should take an active part in planning housing for health.[9] It is desirable in studying housing needs, to have close collaboration between health workers and other local officials, including housing authorities and city planning experts. The appraisal technic of the Committee on the Hygiene of Housing appears to be the most effective tool yet devised for this purpose.

The cost of a housing survey using the technic mentioned above is low. Complete data on 1,280 dwelling units in New Haven were collected and processed at an expenditure of 4 man-months of inspectors' time and between 3 and 4 months' time of one clerk.[8] This would be at a rate of approximately $.80 per dwelling unit. Considering the value of the data for planning for new housing, the rehabilitation of existing homes, and the development of a satisfactory housing inspection program, this is a low unit cost. The appraisal technic can be applied on a sampling basis in known substandard areas, thereby further limiting the total expenditure for any given community.

No health department can afford to carry on without planning and expect to make progress. The objectives of any health program must be clearly understood. It is reasonable to expect that future housing inspection work conducted by health agencies will involve not only consideration of minor structural and maintenance problems, but also broad questions of slum clearance and rehabilitation. It is axiomatic that the first job of a new health unit is to conduct a reconnaissance survey. Why not a similar study of housing?

COÖPERATION BETWEEN HEALTH AND HOUSING AGENCIES

It has been charged that the builders of housing are uncoöperative and fail

to seek competent technical assistance from health departments. This comment unfortunately contains an element of truth.

However, there is another side to the story. Health departments have not always been able and willing to give good technical guidance to the housing construction industry. There is too often a tendency for "health authorities" to tell the public what to do without saying how to do it. Housing is a big business. Its representatives are generally willing to be guided by competent technicians. But it wants guidance of a positive nature.

Some health officers have been mistaken in considering that FPHA projects are government reservations and therefore not subject to health department inspection and supervision. This assumption is wrong, and the Authority is on record as requesting the services of public health agencies in many communities.

Adequate control of housing from the viewpoint of public health requires many forms of protection.[19] Standards for new construction and the rehabilitation or conversion of existing structures are essential. Maintenance and occupancy standards must be enforced. But it is practically impossible to accomplish much in the improvement of housing in a community unless there are satisfactory housing regulations. Health, building, and other officials need authority to make a frontal attack on the numerous problems that confront them all. Such authority usually will result only from the enactment of a local housing code.

The development of modern housing regulations in every locality should be among the first pieces of work of health departments in the post-war years. Public health engineers should be vitally concerned with the content of such legislation, and they have a responsibility to promote it.

DUTIES OF HEALTH DEPARTMENT HOUSING ENGINEERS

The Public Health Service has been coöperating closely with FPHA ever since that agency was created by Executive Order on February 24, 1942. At present, 11 engineers are on full-time detail to FPHA from the Service. One is on duty in the Central Office, and there is also one in each of the ten regional offices of the Authority. These sanitary engineer consultants are concerned with all manner of environmental sanitation problems occurring in war housing. It has been their experience that, if there can be effective coöperation during the development of plans and the selection of sites for multiple-unit housing, many of the sanitation problems that might develop are automatically prevented. Probably the most significant contribution of these men is made in connection with the selection of sites.

The idea of detailing health department engineers full-time to housing work is not new. The Connecticut State Department of Health has had a housing engineer in its Bureau of Sanitary Engineering for several years.

The duties of a housing engineer in a state department of health involve:

1. Analysis of existing housing laws and regulations with a view to the development of new legislation for state and local enactment
2. Training of local public health engineers and sanitarians in modern housing inspection technics
3. Assisting in the organization of local housing surveys
4. Review of plans for major new housing developments (particularly in communities lacking local health services)
5. Consultation with governmental officials and citizens concerning housing sanitation

These are time-consuming jobs. However, they strike at many of the roots of our housing problem, and for that reason are essential.

There is little evidence at present

that city or county health departments would be justified in employing housing engineers as such, except in the largest communities. However, there are numerous opportunities for local public health engineers to concern themselves with housing. These include (in co-operation with public housing officials and private home builders):

1. Development of a satisfactory housing code
2. Organization of a comprehensive inspection program including a plan for evaluating the need for new housing and for the rehabilitation of existing structures
3. Review of plans for new construction
4. Inspection of new construction, particularly of sanitary facilities being provided therein

These duties are obviously important, but they have not always been given the attention due them. It is to be hoped that in the post-war world public health workers will assume their responsibilities in these respects, and that they will take positive action to promote housing for health.

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Further Evaluation of EC Medium for the Isolation of Coliform Bacteria and Escherichia coli*

C. A. PERRY, Sc.D., F.A.P.H.A., AND A. A. HAJNA

Director of Bacteriological Laboratories; and Associate Bacteriologist; Maryland State Department of Health, Baltimore, Md.

AT the St. Louis meeting of the American Public Health Association in October, 1942, the authors had the pleasure of discussing their experience with a new EC medium (buffered tryptose lactose bile salt †) for the isolation of coliform bacteria at 37° C. and of *Escherichia coli* at 45.5° C.[1] In the examination of 147 samples of drinking water of various types, not a single false presumptive was encountered among 1,176 gas tubes while 58.5 per cent of false presumptives were obtained with standard lactose broth. At the same time 14.2 per cent more of the EC tubes were positive for coliforms. The medium was found to have comparable sensitivity to Mallmann and Darby's [2] LST (lauryl sulfate tryptose) medium when tested with 33 stool specimens and 25 samples of raw sewage.

Evaluation of the medium in laboratories other than that of the authors, seemed desirable. However, due to war conditions many laboratories were unable to participate in such an evaluation. Results are presented here from eleven laboratories including that of the authors. Some results from the participating laboratories have had to be excluded because of technical errors.

The completed test for coliform bacteria was used in this study. It is well known that the more steps involved in a routine examination, the greater the number of errors, and it is probable that some of the results presented here are highly inaccurate due to such technical errors. If the short confirmatory procedure of transferring a loopful of culture from the primary gas tube to a secondary tube of brilliant green bile broth had been used, such errors would probably have been largely eliminated and a far better evaluation of the several media might have been obtained. The good results obtained in some laboratories indicate the potential values of these media.

It appears that in actual routine work an unconfirmed presumptive test with either the EC medium or the LST medium is probably much more reliable than the standard completed test. The use of a single primary medium such as EC or LST as a completed test would be valid, however, only if gas resulting from actual fermentation of lactose is recorded. With both these media abundant gas is almost invariably present within 24 hours if positive for any bacteria of the coliform group. Slight traces (less than 1 per cent) of gas in these two media without

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† "EC" refers to *Escherichia coli* though the medium is just as valuable for isolation of coliform bacteria at 37° C. as it is for the isolation of *Esch. coli* at 45.5° C.

effervescence are probably nonspecific gas, for it is well known that such traces of gas may result from various nonspecific causes. It is a routine practice in the authors' laboratory to test for questionable gas by shaking. If definite fermentation of lactose has occurred, effervescent gas will be very obvious. Slight traces of gas have never been found by the authors in either EC medium or LST medium after 24 hours' incubation unless slow lactose fermenters are present. Whenever coliform bacteria have been present, abundant gas has been produced. Slight traces of nonspecific gas without effervescence do occur in some laboratories for the reasons noted. Such traces of nonspecific gas can usually be avoided by suitable technical precautions and their nonspecific nature determined by shaking. Traces of gas, however, should always be confirmed.

In order to show the wide variations in results obtained by the participating laboratories, the results were separately compiled. The results also were compiled according to the type of material under examination. In accordance with our earlier report,[1] very few false presumptive tests were obtained with the EC medium by bacteriologists in five of the participating laboratories (A, B, C, D, and E). Only six, or 0.6 per cent, false presumptives were found among 945 EC gas tubes. It is doubtful, however, if the six so-called false presumptives were really false, as slow-lactose-fermenters were recovered from two similar tubes and possibly were present in these six tubes had they been available for critical reëxamination. The results with the LST medium were also excellent. With the same samples, 654 LST gas tubes were obtained against 650 with the EC medium. There were no false positive EC gas tubes, however, while 15, or 2.3 per cent, were found with the LST medium. False "false presumptives" due to slow-lactose-fermenters, could be expected to be the same with both media. The percentage of false presumptives using standard lactose broth (SLB) varied from 0 to 97.9 per cent and averaged 24.2 per cent.

No evaluation of the lauryl sulfate medium at 45.5° C. was attempted but the EC medium was found highly specific for *Escherichia coli* at this temperature. While a small percentage of false presumptives was encountered with the authors' original modified Eijkman medium,[3] only one, or 0.17 per cent, out of 603 EC gas tubes obtained at 45.5° C. failed to confirm for *Escherichia coli.*

Unfortunately, the results from six other collaborating laboratories (F, G, H, I, J, and K) were not so satisfactory. The percentages of false presumptives with Laboratory "F" were small for both the EC and LST medium and relatively small for SLB. Laboratory "G" found relatively low percentages of false presumptives with all three media and the sensitivity of the EC medium was considerably lower than that of the LST or SLB. Laboratory "H" tested all three media on samples of shellfish and of raw and chlorinated water. It is stated in the report from that laboratory that "the adoption of the LST medium as the standard medium would result in coliform indices somewhat larger than at present with SLB and that the use of the EC medium would effect a sharp reduction in the number of false presumptives." The following data have been presented by that laboratory after they had deleted certain questionable samples.

Medium	*Primary Gas Tubes* *	*Completed Test* *
SLB	9.7	4.6
LST	6.7	4.7
EC	4.7	4.4

* as M.P.N. per sample

These computations obviously were not made from the data as presented in this

report, which had from 11.3 to 24.4 per cent false presumptives for the EC medium and from 6.8 to 24.1 per cent for the LST medium. Those for standard lactose broth varied from 13.8 to 56.0 per cent. Significant data were selected.

Detailed results for each of the participating laboratories have been deleted on account of space. A summary of the results from all of the participating laboratories is given in Table 1.

TABLE 1

Comparative Sensitivity and Specificity of EC, LST and SLB Media for the Isolation of Coliform Bacteria

(Condensed Table)

Material, Samples and Tubes	Medium	37° C. Incubation: Coliforms: Gas Tubes	No. Pos.	Per cent False Presump.	Esch. coli: No. Pos.	Medium	45.5° C. Incubation: Tubes Inoc.	Gas Tubes	Esch. coli	Per cent False Presump.
					Laboratories A, B, C, D, E					
* S 711 T 4880	SLB	1,117	847	24.2	620	ME	1,265	600	588	0.3
S 370 T 2700	EC	945	936	0.6	728	EC	1,265	603	602	0.17
	LST	654	639	2.3	506					
					Laboratories F, G, H, I, J, K					
† S 284 T 2436	SLB	1,509	1,253	15.0	127	ME	198	130	109	16.2
S 259 T 2236	EC	1,390	1,210	13.0	123	EC	198	122	101	17.2
	LST	1,383	1,178	14.8	116					

SLB = Standard Lactose Broth
LST = Lauryl Sulfate Tryptose
ME = Modified Eijkman
* Samples of human feces, shucked oysters, milk, sewage, and various types of water
† Samples of shellfish and various types of water

The reason for the high percentages of false presumptives obtained by some of the collaborating laboratories may be due to reading tiny bubbles of air or nonspecific gas as "positive" when there is no fermentation of lactose. Such traces of gas are apt to be entrapped air or that resulting from dextrose formed by hydrolysis of lactose. Air may be forced into some tubes when running water from pipettes. Dr. Black's report [4] on technical errors in the bacteriological examination of milk indicates how widespread technical errors may be. Technical errors are doubtlessly as widespread in water examinations. The impossibility of evaluating any method unless technical errors can be controlled, is obvious. It is hoped that further work may help to determine the validity of these results and the exact cause of probable technical errors.

CONCLUSIONS

The results indicate to the authors that both the LST medium and the EC medium are highly sensitive and specific media for the isolation of coliform bacteria from water, shellfish, and sewage. The EC medium has also given excellent results for isolating both coliform bacteria at 37° C. and *Escherichia coli* at 45.5° C. from milk. If errors probably due to reading gas resulting from entrapped air, hydrolysis of lactose, and often other factors can be eliminated, positive presumptive tests with both the EC medium and the LST medium have been found to be indicative of the presence of coliform

bacteria in almost 100 per cent of cases. While both the EC and LST medium are highly efficient in the isolation of coliform bacteria, the EC medium is somewhat more specific. A presumptive test reading with either the EC or the LST is obtainable which seems to be far more dependable than the usual "confirmed" or "completed" test result. Both of these media offer rapid tests of great dependability which should be of the utmost importance under war conditions and in peacetime for, when properly performed, they give highly dependable results within 24 or, at most, 48 hours.

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Industrial Hygiene in the Post-War World*

JAMES G. TOWNSEND, M.D., F.A.P.H.A.

Chief, Division of Industrial Hygiene, National Institute of Health,† U. S. Public Health Service, Federal Security Agency, Bethesda, Md.

THERE can be no doubt that the war has set the stage for a new industrial era in the United States when hostilities shall have ceased. By the same token, we can clearly envision a new era of industrial hygiene in the post-war world. I am well aware that the phrase "new era" carries, somehow, a meaning of promise and optimism. But "newness" in itself never has connoted a change for the better. Post-war industrial hygiene will be just what we make it—an effective tool for the advancement of human health and welfare or solely a specialty of scientific research and medicine.

We are now at the flood-tide of war production. The industrial plant of the United States and our labor force are the largest in the world's history. Within the limits of available funds and trained personnel, the nation's industrial hygiene services both public and private have reached their peak of performance.

From this vantage, what can those of us—equipped by training and experience to anticipate problems and needs in industrial health—visualize as our future task? How can we best meet the problems and needs? Where do we go from here?

The answers to these questions are found in joint planning on the part of all interested groups, under the leadership of those with the "know-how." But unfortunately, at a time when we most need concerted thought and action, post-war planning has become more or less a free-for-all. Diverse plans are being placed before the public, and various writers in various occupations have submitted schemes for the world of tomorrow. This being the case, I do not hesitate to enter the arena, for although any public servant nowadays expects to be dubbed "bureaucrat," I have not yet been called a "long-haired professor," and hence may be allowed to speak my piece.

DEFINING THE PROBLEM

Reliable estimates of the need for industrial hygiene services depend upon our ability to define the problem in every area of operations—plant, community, state, and nation.

At the present time, reliable data in the industrial hygiene field are scant. For example, our estimates of disabling sickness among the nation's workers and the trends in occupational morbidity and mortality are based upon a very small sample. The records submitted to the Public Health Service for analysis cover some 250,000 individuals employed in a limited num-

* Chairman's address presented before the Industrial Hygiene Section of the American Public Health Association at the Seventy-second Annual Meeting in New York, N. Y., October 12, 1943.

† Since this paper was prepared, the Division has become the Industrial Hygiene Division, Bureau of State Services, U. S. Public Health Service.

ber of trades. These studies constitute the best available estimates of industrial disability and are of great value in demonstrating the methods of disability reporting and analysis.

Occupational disease reporting in the United States is so inadequate as to be worthless. Twenty-five states have laws or regulations or both relating to occupational disease reporting. Other sources of data are the 27 bodies administering the various state compensation laws. But since these laws vary in coverage and in other particulars, the diseases reportable and the methods of reporting vary to such an extent that at present no comparable data can be assembled. If we are to have the epidemiologic intelligence needed in attacking any public health problem, the states will have to come to some agreement on uniform reporting of occupational diseases and will have to enact appropriate legislation.

The compilation and analysis of data on disabling sickness and occupational disease require the attention of statisticians skilled in the interpretation of mass data. Here the state vital statistics bureau or the state division of statistical services could be of enormous help to governmental industrial hygiene units and industry by providing good statistical services. This is being done with considerable success in connection with disabling sickness by the Tennessee Division of Statistical Services, a unit of the State Department of Public Health. Although the work began with a sample of industrial plants in the state, the results in valuable information on the how, when, and where of industrial disability have been such as to require an expansion of the service.

The economics of industrial hygiene is one of the most important and most neglected areas of information. There are no data available on the *total* national expenditures by all sources for industrial health and safety services. Estimates have been made of the costs of in-plant services and a few interested industries have attempted to correlate costs of services and savings in costs of compensation, time loss, labor turnover, etc. Much work needs to be done in this field. Industry and labor, insurance companies, and governmental agencies all have a stake in the development of more complete information on industrial hygiene economics. Further expansion depends heavily on our ability to estimate the practical benefits of industrial hygiene. Better information on the costs of services might lead to the development of more effective utilization of funds, facilities, and personnel, and hence to important savings and better services.

If then, war's end presents no new problems, reëvaluation of the industrial hygiene problem, improvements in epidemiologic information, and the collection and analysis of data on the costs of industrial hygiene offer a stimulus to greater effort.

POST-WAR PROBLEMS

The cessation of hostilities, however, will accentuate rather than reduce the need for industrial hygiene facilities. Although we have learned much about many of the new materials introduced during the war and scheduled for much wider use in consumer production, we will be faced with the potential hazards of entirely new processes, new types of jobs, and still newer materials.

Proper placement of workers returning from the armed forces or from war industries will be of outstanding importance, especially in relation to service-connected disabilities. We have only made a beginning in the effective adjustment of handicapped persons to industry. This war cannot be followed by blanket rejection of the physically handicapped from industrial employment. It is the responsibility of

industrial hygienists to see to it that jobs are fitted to men and men to jobs.

The U. S. Civil Service Commission has made a careful job analysis of some 2,500 occupations to determine the jobs for which service men with varying types and degrees of disability could be trained. It is expected that the findings of the study will be utilized by national and state rehabilitation services and by industry in the selection, placement, and reëducation of disabled service personnel.

Threshold training of new workers by industry and educational institutions has been introduced during the war as a means to provide quickly the all-essential man power. In the reëducation of former workers and the training of service men for industrial employment, this same method of job instruction will be used on a wider scale. Here, industrial health and safety personnel can exercise a powerful influence by introducing concurrent training in safety practices and in the recognition by supervisory personnel of potential hazards. Plans for integrating industrial hygiene with post-war vocational education and rehabilitation should be made now.

Demobilization of our armed forces and of war industries will result in an even more drastic and acute transmigration of workers and their families, with attendant social and economic dislocations that will augment the problems of medical care, particularly as it relates to industrial hygiene.

Already plans are being advanced by industry for the conversion of war establishments to consumer production. As in conversion to war production, health and safety of the workers must be considered at every stage of the transition—from the blueprint to full operation.

New industrial hygiene problems will be posed by pre-war industries now grown to giant size, and destined to find a comparable place in the peacetime economy. Notable in this group is air transport. Much that we have learned in creating our superb United States air force can be applied to post-war aviation. But problems as yet unsolved and others anticipated will require intensified research and application of new knowledge. For example, civilian aviation and air transport will not only bring in the "air age," but also airplane accidents. While aeronautic engineering and plane production have advanced consistently in solving the problems of mechanical failure, we know very little about the human factor in airplane accidents. The selection of flight personnel, pilot fatigue, air sickness, and the physical fitness of personnel, passengers, and civilian fliers for flight—all need study. In the post-war world, these problems of aviation medicine have industrial hygiene implications that cannot be overlooked

Other industries and processes have come out of the laboratory during the war and will be important in post-war industrial hygiene. The manufacture and processing of plastics and synthetic rubber on a large scale are here to stay. So also are welding and fabrication of light and heavy metals, x-ray inspection of industrial materials, and a dozen others. Each of these new technologies presents potential hazards of a serious nature which must increasingly demand our attention as their use expands.

The substances used in the manufacture and processing of synthetic products have been under investigation by the Division of Industrial Hygiene, National Institute of Health, for some time. Likewise, rare metals such as beryllium which have hitherto been little used in industry are still under study. As similar substances come into wider and *newer* use, research must continue and large-scale application of control methods must be envisioned in

post-war industrial hygiene work. Both industry and government should plan together now how present knowledge may be applied to consumer production.

Furthermore, developments in the post-war industries will undoubtedly see the introduction of new substances and processes. Close coöperation between industry and governmental industrial hygiene services is needed in order to eliminate the lag between the introduction of new potentially hazardous substances and the determination of their toxicity and of control measures.

The pressure of war production has made it impossible in many cases for industry to apply control measures before outbreaks of occupational disease occurred. If industrial hygiene is brought in on the ground floor of planning for post-war production, much needless human waste can be prevented.

If an industry knows that a new substance or a new process is to be important in its post-war program, now is the time to subject the problem to industrial hygiene investigation. Within the last year, the munitions industry profited by securing this type of foreknowledge. When there were only a few pounds of a new explosive in the United States, laboratory research in the Division of Industrial Hygiene and the War Department determined the toxicity and defined the control measures for the safe large-scale use of the explosive. Obviously, this method affords important economies both in the installation of processes and in the prevention of disability.

Governmental industrial hygienists may well anticipate in the post-war period, if not before, the added responsibility of occupational disease and accident control in agriculture. Although some work has been done on the health and safety problems of agricultural workers, the field remains virtually untouched. Should these workers be brought under the provisions of the Social Security Act, a further expansion of state and local industrial hygiene services will be essential.

We have not yet considered the means with which we are to meet the post-war problems of industrial hygiene. This is a problem in itself. First in importance is the dearth of professional and technical personnel. The specialty of industrial hygiene had scant attention in our medical and engineering schools before the war. Postgraduate training in the professions has already suffered more than we realize as a result of war. One of the most serious responsibilities facing us today is the training of young physicians and engineers who have gone directly from school to the armed forces and who are not prepared to give industrial hygiene the transfusion of new blood it must have. Although some postgraduate training of nurses is being done, the vast majority of the young women now being trained in the U. S. Cadet Nurse Corps will go into bedside nursing. Their absorption into public health and industrial nursing after the war depends upon our ability to give them the training essential in these specialties.

The training of other professional personnel, technicians, and sub-professional workers for industrial hygiene service offers a similar challenge. There will be many competent young men and women returning from our armed forces who are accustomed to the development of skills and to discipline. We should begin now to plan intensive training in industrial hygiene, not only for the physicians, engineers, chemists, and nurses, but also for the technicians and other personnel who will be needed.

It is not too soon for official and nonofficial industrial hygiene services to approach the educational institutions with a view to the establishment of training facilities. Under the pro-

visions of Title VI of the Social Security Act, the U. S. Public Health Service before the war developed with numerous universities a program for the public health training of state personnel. Due to the lack of educational facilities, little specific training in industrial hygiene could be done. When the war is over, we should be in a position to write a strong industrial hygiene education plan into the public health training program. The establishment of new facilities in existing schools of engineering and medicine would not only service personnel of official agencies but would attract students destined for employment in industry.

FINANCING INDUSTRIAL HEALTH SERVICES

Those industries which have established adequate in-plant health and safety services, I am confident, will continue and even expand the facilities as needed. It is in such plants that we find the practical demonstration of the best that industrial hygiene has to offer. This group is still woefully small, a microcosm in an industrial establishment so large that it already staggers the imagination!

The large group of small plants in the United States probably cannot afford individual in-plant services, but can undoubtedly be interested in any practical plan for the joint utilization of a central community industrial health and safety service. The majority of plants in all size groups, however, do not have in-plant services and appear content with perfunctory compliance with the minimum requirements of workmen's compensation laws.

Nevertheless, a good proportion of the industrial establishments in this country, and the labor unions, too, have learned more about industrial hygiene in the past two years than they ever knew before. Management and labor, then, are the sources from which demands for more services will come, and I am sure the demand will continue—in crescendo.

I do think, however, that any substantial real expansion of industrial hygiene work in the future depends upon certain eventualities. First, if management, labor, and the government acquire a larger financial stake in workers' health and safety, obviously increased facilities will be demanded, both within the plant and in consultant and technical services. There is now before the Congress legislation which would provide health insurance for workers covered under the Social Security Act. If this or similar legislation is passed, the three contributors to the insurance plan will insist upon adequate preventive services to reduce time loss due to disability.

Further legislative action with respect to the health and safety of industrial workers should be on the post-war agenda of the states, management, and labor. Legislation requiring minimum safeguards against occupational hazards is still inadequate in certain states. The inspection forces are not sufficient to detect every case of non-compliance with existing laws. In order to equalize the hazards to workers and the costs to industry throughout the country, adequate legislation and adequate services are essential in every state.

Another factor contingent to the expansion of industrial hygiene is the participation of state and local governments. Have they been participating enough? The record is clear. For the fiscal year 1943–1944, state and local industrial hygiene services have budgeted $1,225,000 from all sources. Of this total, 49.8 per cent is in federal funds. An additional $209,000 was budgeted in salaries of personnel loaned by the Public Health Service under the Emergency Health and Sanitation Appropriation. Thirty-five state health

departments contributed a little over one-fourth, or 27 per cent. Two state departments of labor budgeted 13 per cent of the total, and 10 local health departments contributed slightly over 10 per cent.

Industrial hygiene services in 7 states are financed this year entirely by federal funds, and 8 others receive from three-fourths to over 90 per cent of their funds from the same source. Thirteen other units derive from one-half to three-fourths of their budgets from federal funds. Thus, in 60 per cent of the 47 existing governmental industrial hygiene services, the major cost is borne by the federal government. It should be said, in all fairness, that this record is a considerable improvement over that in the years immediately following the passage of the Social Security Act, or even over that of last year.

These expenditures are all exclusive of salaries of Public Health Service personnel assigned to state units under the Emergency Health and Sanitation Appropriation, as already stated. However, we must not lose sight of the fact that the Emergency Health and Sanitation program is limited by the duration of the war and 6 months thereafter. It is important, therefore, that the states include in their post-war plans the taking up of this deficit.

These facts make clear the pitifully small effort for the health and safety of our industrial population both before and during the war. No one thinks for a moment that American industry will be reduced to its pre-war stature even after the post-war transition to consumer production. Certainly, the future promises a period of industrial activity greater than at any time in the ten years preceding the war. Some of the nation's most influential industrialists have stated frankly that the present and future problems of production are not in engineering and operations, but are human problems—how to increase the efficiency and promote the well-being of the men and women whose stake in modern industry is their labor. The provision of adequate health and safety services is the first step toward realizing that goal.

The service rendered by state and local industrial hygiene units is the spear-head for the future advance of industrial hygiene. I will go further. It is the spear-head for the future advance of public health. Aside from the need for specialized services in the control of occupational diseases and accidents, the industrial hygiene program offers the channel for the ultimate control of such long-fought diseases of public health importance as tuberculosis and venereal disease; for the advancement of public health dentistry; and adult hygiene in general.

Governmental industrial hygienists at every level are well aware that state and local governments are not meeting their industrial hygiene responsibilities. Lack of funds has often been given as an excuse. But is it not possible that a little thought, a little better planning of budgets, and a real effort to inform local health officers and appropriating bodies might bring to light enough money and enough elbow-grease to strengthen industrial hygiene services?

There are no non-industrial states in the United States. The war has industrialized many areas hitherto entirely rural. Yet, 10 states still have no industrial hygiene services whatsoever.

The present minimum staffs in the 38 states having such services must be strengthened, and because of the wide dispersion of industry it is desirable to decentralize services in industrial hygiene at district, city, and county health department levels.

These are important pieces of unfinished business which the public health movement must complete, either now or after the war. Failure to do

so will mean that public health has missed its great chance to serve as a leader in the promotion of national well-being.

INTERNATIONAL RELATIONS IN INDUSTRIAL HYGIENE

After the war, the reconstruction of occupied territories, the transition from war production to a peace economy in the United Nations, and the expansion of industry in backward countries will present innumerable industrial hygiene problems best solved by an interchange of knowledge and skills. Any plans for post-war rehabilitation should include plans for industrial health and safety. The industrial hygienist should be given the same responsibility in national and international programs for the promotion of workers' health as has been given to public health and medicine in the United Nations' plan for the improvement of human nutrition.

Industrial hygiene in the post-war world has a magnificent opportunity to advance human health and welfare through the application of the knowledge and experience gained during the war. Those of us who have shared that experience should begin now to project our thoughts into the future and consider how best we can serve in the post-war world—for it will be a world of work.

Proposed Report on the Educational Qualifications of Medical Administrators of Specialized Health Activities*

Considered in This Report Are the Following Specialized Activities: Maternal and Child Health, Control of Tuberculosis, Venereal Disease, Cancer, Mental Hygiene, and Industrial Hygiene.

AMONG essential health services are specialized activities, that is, activities designed for the control of individual diseases or groups of diseases, and for safeguarding and promoting the health of selected population groups. All such activities are concerned with the large scale application of highly technical medical knowledge; all of them include the continuous observation of many individuals over long periods of time, and all of them require the use of numerous facilities in the health agency and elsewhere in the community. Each specialized activity calls for a medical administrator who is a physician qualified both in his particular line of work and in the general field of health administration. For many years maternal and child health programs and services for the control of tuberculosis, syphilis and other venereal diseases have been organized as separate units in health agencies of any considerable size. Specialized activities more recently organized similarly include those for industrial hygiene, mental hygiene, and the control of cancer, and it is to be expected that additional new undertakings will be placed in the same category. Duties and functions, and educational and personal qualifications common to medical administrators of all specialized activities will first be presented in this report, followed by a summary of desirable postgraduate clinical training and experience in each field.

The duties of the medical administrator who serves under the general direction of the health officer include participation in clinical activities to a greater or lesser degree depending upon the size of his medical staff. Even in large organizations, he serves as a consultant, and in smaller agencies he serves as a clinician and takes part in diagnostic and treatment activities. He also is responsible for securing the coöperation and assistance of the medical profession and for judging the effectiveness of clinical procedures in force and the efficiency with which they are carried out. The medical administrator is responsible for changing clinical and other activities so that they comply with the best modern practice, and he must be capable of taking advantage of new discoveries of public health importance. He has opportunity for research of his own and of inaugurating special studies and research for the members of his staff.

* The Committee on Professional Education of the American Public Health Association publishes this report before transmittal to the Governing Council in order to permit the members and Fellows of the Association to review it and to offer criticisms and suggestions in the further consideration of the report. It would particularly welcome suggestions as to the amplification of the various specialties included in the report.

This report, like all other statements of the committee on professional and technical qualifications in public health, is subject to periodic revision in order that it may be kept abreast of the best thought.

Specialized health activities all require the establishment and maintenance of systems of reporting and of registers for keeping patients and their associates, and other classes of individuals under continuous observation. The medical administrator's duties include supervision of those record systems and responsibility for the character and quality of data collected in them. Such data largely result from clinic and field services. Most important among the latter are services rendered by public health nurses. It is the duty of the administrative officer to formulate definite policies for home visiting and other public health nursing activities in his field. Control measures for diseases under the heading of special activities and for promoting the health of selected population groups are by no means limited to those administered by the director of a given activity. The medical administrator uses numerous health department facilities, such as laboratory services, those in health education, in environmental sanitation, and in special activities other than his own. His duties include a thorough understanding of related work done by other agencies, official and voluntary, and he may advise or assist in programs besides those in the health agency to which he belongs.

The staff of units for special activities in large organizations usually includes several physicians, and there may be a number of full-time positions under such titles as assistant director and clinical consultant. Natural lines of promotion are from those subordinate positions to that of medical administrator. Qualified physicians with full-time administrative experience in smaller agencies are to be considered eligible for higher grades of positions in larger organizations. Part-time physicians are frequently employed in specialized activities to serve in clinics and for other technical purposes. As a rule these physicians have few, if any, administrative duties, and are not to be regarded as qualified for medical administrative positions until they have had the necessary public health training and experience.

PERSONAL QUALITIES

The medical administrator of specialized activities should have the same personal qualities that make for success in other administrative positions. He should, in brief, possess such personal characteristics as adaptability, common sense, creative ability, good health, judgment, leadership, and pleasing personal appearance.

EDUCATIONAL BACKGROUND

Basic educational qualifications for medical administrators of specialized activities are the following:

1. Fundamental training in the sciences and humanities at least equivalent to that required for a college degree in the arts and sciences
2. Completion of a course leading to the degree of Doctor of Medicine in an approved medical school
3. Internship of at least one year in an approved general hospital
4. Eligibility to examination for medical licensure in the state where service is to be rendered

GRADUATE TRAINING AND EXPERIENCE

Graduate clinical training and experience in each special activity under discussion are summarized below. Practical considerations sometimes demand that graduate training in the special activity be combined with training in public health. The following statement takes this fact into account, but it is preferable for the medical administrator to have the requisite amount of clinical training before enrollment in a public health course.

1. Completion of a program of study [1] of not less than one full academic year in a university leading to a degree in public health.

Such a program should cover the general field of public health: administration, biostatistics, environmental sanitation, epidemiology, health education, laboratory methods, public health nursing, and should be accompanied by special instruction in the application of the basic principles learned to the functions and duties of the medical administrator's special activity, and, if necessary, instruction in the clinical features of the activity.

2. Experience in general administration or in a subordinate position is desirable for all medical administrative positions.

REFERENCE

1. See "Memorandum Regarding Minimum Educational Facilities for the Postgraduate Education of Those Seeking Careers in Public Health," prepared by the Committee on Professional Education, American Public Health Association and published in the *American Journal of Public Health*, May, 1942.

SUMMARY OF GRADUATE TRAINING AND EXPERIENCE IN SPECIALIZED HEALTH ACTIVITIES

The following summaries present desirable graduate training and experience for career service in the administration of specialized activities. Recognition is given to the fact that long clinical experience and distinguished service in the special field may take the place of formal training in an institution or hospital.

MATERNAL AND CHILD HEALTH

Two years of graduate training in pediatrics or obstetrics or both; part of the candidate's experience should preferably be in the administration of a program under supervision.

TUBERCULOSIS

Two years' graduate training in tuberculosis in an approved tuberculosis sanatorium or hospital, or equivalent training in an outpatient service; part of the candidate's subsequent experience should be in the administration of a tuberculosis program.

VENEREAL DISEASE

Two years' graduate training in the diagnosis and treatment of venereal diseases in an approved hospital, or outpatient service; part of the candidate's subsequent experience should be in the administration of a venereal disease program.

CANCER CONTROL

Two years' graduate training in the diagnosis and treatment of cancer, including training in the pathology of the disease.

MENTAL HYGIENE

Two years' graduate training in psychiatry in an approved mental hospital, and one year's experience in outpatient work with children in a clinic employing the integrated services of psychiatrist, psychologist, and psychiatric social worker. Desirable supplemental experience includes clinical neurology, service in institutions for epileptics, mental delinquents, and defectives, and neuropathology.

INDUSTRIAL HYGIENE

Clinical graduate training for medical administrators in industrial hygiene may be in the field of industrial toxicology and in the diagnosis and treatment of occupational diseases. The medical administrator should have good knowledge of physiologic problems, and he should be trained to serve in directing rehabilitation services for the handicapped and in the technics of accident prevention and safety. Training and experience are best secured by service in an industrial plant.

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The Cuban Government Honors General Simmons

On May 17, at the invitation of the Cuban Government and Dr. Alberto Recio, the Minister of Health, Brigadier General James Stevens Simmons, Chief, Preventive Medicine Service, Office of the Surgeon General, U. S. Army, visited Havana and took part in the dedication of the new National Institute of Health. During the ceremonies President Batista decorated General Simmons with the Medal of the Carlos J. Finlay National Order of Merit in the grade of *Gran Official*.

The President also sent by General Simmons to Major General Norman T. Kirk, the Surgeon General of the Army, a certificate conferring the Carlos J. Finlay Order of Merit in the grade of *Gran Cruz* on the former American Yellow Fever Commission for its fundamental experimental work in Cuba on the etiology and transmission of yellow fever under the leadership of Major Walter Reed. The certificate will be preserved in the Army Medical Library in Washington.

A Fly-borne Bacillary Dysentery Epidemic in a Large Military Organization*

COLONEL DWIGHT M. KUHNS, M.C., F.A.P.H.A., AND FIRST LIEUTENANT THEODORE G. ANDERSON, SN.C.

United States Army, Fort McPherson, Ga.; and Army of the United States, Fort McPherson, Ga.

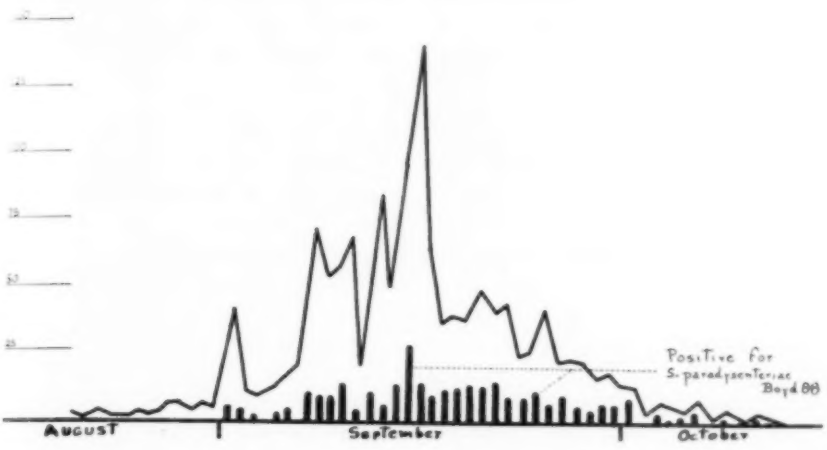
THE purpose of this paper is to report a massive epidemic of bacillary dysentery in which the same specific pathogenic organism was isolated from both flies and dysentery cases. The outbreak occurred in a large military unit which was in bivouac in one of our southern Army camps. Clinically, the dysentery was typical but of short duration. The average duration of the disease in ambulant cases was 2 days and the average hospital stay of the more severe cases was 7 days. Although this might indicate that the type of dysentery was not severe, there was considerable weakness and disability following the disease. A decisive part of a Division was thus incapacitated in this particular outbreak of 1,557 cases of clinical dysentery. Three hundred and eighty-three of the cases were bacteriologically positive. The causative organism, in 91 per cent of those found positive, was serologically and biochemically identified as *Shigella paradysenteriae*, Boyd 88. Figure 1 shows the incidence of cases and the number of stools found bacteriologically positive. This incidence was determined by taking a brief history of all individuals in the entire Division who stated that they were having or had had the disease. The number of those found to have positive cultures was determined by culturing, after September 25, 1942, all individuals with a history of having had the disease while in bivouac at this site. Figure 1 indicates that the incidence of dysentery began to increase about two weeks after the Division had been in bivouac in this area. There was no history of the presence of flies prior to the occupation of this area by the Division. About September 1, flies began to appear in numbers which became larger as the intensity of the epidemic increased. The decrease in case incidence was accompanied by a decrease in fly incidence. The latter was partially due to the enforcement of strict fly control measures and to the appearance of cool weather.

SANITARY SURVEY

A general sanitary survey showed a marked deviation from the usual enforcement of the well known sanitary protective measures. These difficulties arose in part because the stay of this unit in the bivouac area, which was originally supposed to be of short duration, was extended into weeks by exigencies of the Service. The survey showed that water, ice, and milk were satisfactory. The progressive, rather than abrupt, nature of the outbreak and

* Presented at a Joint Session of the Epidemiology, Health Officers, Maternal and Child Health, and Laboratory Sections of the American Public Health Association at the Seventy-second Annual Meeting in New York, N. Y., October 14, 1943.

FIGURE 1—Cases of Dysentery, X-Division, X-Camp, 1942 (According to date of onset as given in individual history records)



the simultaneous occurrence of the disease in all parts of the entire area indicated that the means of transmission of the infection was not food handlers.[1] However, a lack of proper operation of latrines permitted direct fly contact with human excreta. The open, straddle trench type latrines were in use but were being replaced by the enclosed box type. Excreta in some of the remaining straddle trenches was uncovered and accessible to flies. Flies were found breeding in the old closed latrines of units previously bivouacked in the area. Innumerable flies were everywhere. Inadequate protection of messes against flies afforded opportunity for the direct contamination of foodstuffs during preparation.[2, 3] These conditions, aided by latrine flooding that disseminated fecal material to greater fly contact, apparently were factors in precipitating the epidemic.[4, 5]

After an increased number of dysentery cases began to appear, steps were immediately taken to eradicate the flies and to improve general conditions of sanitation and food protection. By the latter part of October, there was a general enforcement of all sanitary measures which resulted in a marked reduction of the fly population.

It is interesting to note that dysentery abruptly stopped in one unit when it was sent from the bivouac area for training purposes to an area relatively free from flies.

METHODS AND MATERIALS

Due to the military situation, it was desirable to know something of the extent and type of infectious organisms present in the organization, as well as to investigate the possibility of confirming the rôle of the fly as the transmitting vector.[5, 7, 8] Therefore, a mobile laboratory and staff were sent to the site of the epidemic in order to study the outbreak at its origin.

A rectal swab culture survey was made of all individuals in the Division who were having or gave a history of having had the disease and of all permanent food handlers. In addition, the state of infectivity of the Division was analyzed by *selecting and culturing* one entire company as a sample. Flies were cultured from various sources, which will be shown later.

The Hardy[9] rectal swab method was

TABLE 1

Results of Swab Cultures from All Men in the Division With History of Diarrhea During Epidemic Period

	Days from Recovery to Culture	Number of Cases	Positive for Shigella	
			No.	Per cent
Men with history of diarrhea	Current	366	161	43.9
	1–7	125	31	24.8
	8–15	269	68	25.3
	15–21	435	67	15.4
	22–28	222	40	18.0
	More than 28 days	125	16	12.8
	Days not recorded	15	0	0.0
Total men with history of diarrhea		1,557		
Total positive for shigella			383	24.6

used for collecting specimens from all individuals cultured in this investigation. The swab collected by this method was placed into Selenite-F broth (Balt. Biol. Co.) and incubated at 37° C. from 12 to 16 hours. At the end of the incubation period, plates of Salmonella-Shigella (Difco) media were streaked directly from the Selenite-F tubes. All plates were incubated for 24 hours at 37° C., when several clear colonies were picked and inoculated into Kligler Iron (Difco) slants. All typical Shigella growths, after 24 hours' incubation at 37° C. on Kligler Iron, were checked biochemically and serologically. The serological confirmations were made by spot agglutinations, using a 1:10 dilution of the specific Shigella antiserum. For specific polyvalent (V, W, X, Y, Z) differentiation and for confirmation of the specific types, *Shigella paradysenteriae*, Boyd 88, *Sh. sonnei*, and the other species isolated, macroscopic serial dilution agglutination tests were conducted.

Flies collected in fly traps were triturated and cultured in lots of 15 in the same manner as that described for the rectal swabs.

RESULTS OF BACTERIOLOGICAL OBSERVATIONS

Rectal Swab Cultures from All Individuals with a History of Diarrhea—

TABLE 2

Classification of Pathogens Isolated

Days from Onset of Disease to Culture	Sh. paradysenteriae, Boyd 88	Sh. sonnei	Sh. paradysenteriae, "X"	Sh. paradysenteriae Race Undetermined	Sh. alkalescens	Sh. dispar	Species Undetermined	Negative	Total Number Cases
Current	146	8	2	1	2	2	0	205	366
1–7	30	0	0	0	1	0	0	94	125
8–14	65	1	0	0	0	1	1	201	269
15–21	59	2	0	0	5	1	0	368	435
22–28	40	0	0	0	0	0	0	182	222
Over 28	11	2	0	0	0	3	0	109	125
Days not given	0	0	0	0	0	0	0	15	15
Total	351	13	2	1	8	7	1	1,174	1,557
Percentage of total cases	22.5	0.8	0.12	0.06	0.51	0.45	0.06	75.5	
Percentage of pathogens isolated (383)	91.6	3.37	0.52	0.26	2.09	1.9	0.26		

NOTE: Six of the cases yielding Boyd 88 were complicated with one of the other *Shigella paradysenteriae* strains but were included under Boyd 88 because this strain was the predominating one.

Cultures were taken from 1,557 men in the Division who had diarrhea or who gave a history of having had diarrhea during this outbreak. The number found to be positive for Shigella was 383, or 24.6 per cent, as shown in Table 1. It is interesting to note from the table that 28 days after the infection 12.8 per cent of the individuals cultured were still positive for Shigella organisms. The predominating organism was *Shigella paradysenteriae*, Boyd 88, which represented 91.6 per cent of the pathogens. Other organisms present were *Sh. sonnei, Sh. paradysenteriae*, "X", *Sh. alkalescens*, and *Sh. dispar*. (Table 2).

Rectal Swab Cultures from Food Handlers—Due to the fact that the disease was widespread, it was believed that a large number of food handlers were infected and thus might contribute to the continuation of the epidemic. Therefore, all permanent food handlers were cultured to determine those carrying the organisms. Positive rectal swab cultures were obtained from 58 of the 528 food handlers (see Table 3).

This group actually constituted a sample of 528 men chosen at random from the entire Division. When divided according to the presence or absence of a history of diarrhea, it was found that 10 (12.0 per cent) of 85 food handlers with a history of diarrhea were positive, whereas 48 (10.8 per cent) of 443 without such a history were positive. These results demonstrate that in this epidemic the

TABLE 3

*Results of Stool Cultures from Food Handlers**

	Days from Recovery to Culture	Number of Cases	Positive for Shigella	
			No.	Per cent
Food handlers with history of diarrhea	Current	7	3	43.0
	1–7	8	0	0.0
	8–14	19	3	16.0
	15–21	21	0	0.0
	22–28	11	1	9.9
	More than 28 days	19	3	16.0
Total food handlers with history of diarrhea		85	10	12.0
Total food handlers with no history of diarrhea		443	48	10.8
Total food handlers cultured		528	58	10.9

* Permanent food handlers from all messes in the division

TABLE 4

Results of Stool Cultures from an Entire Company, A Sample Survey of the Division

	Days from Recovery to Culture	Number of Cases	Positive for Shigella	
			No.	Per cent
Men with history of diarrhea	Current	4	3	75.0
	1–7	4	1	25.0
	8–14	3	1	33.3
	15–21	10	2	20.0
	22–28	5	2	40.0
	More than 28 days	6	0	0.0
Total men with history of diarrhea		32	9	28.1
Total men with no history		111	23	20.7
Total men cultured		143	32	22.4

presence of the carrier state was independent of a history of diarrhea, and indicate that subclinical infection was widespread.

Rectal Swab Cultures from One Entire Company — A representative sample of the Division, consisting of one company (143 men), was cultured. The number of men who gave a history of having had diarrhea was 32; of these, 9, or 28.1 per cent, yielded positive cultures. Of those who gave no history of diarrhea, the percentage found positive was 20.7. Of the entire company, 22.4 per cent were found to be carriers of Shigella organisms (Table 4).

TABLE 5

Cultures from Flies

Source of Fly Batches *	*Positive for Shigella paradysenteriae, Boyd 88*	*Negative for Pathogens*
169 kitchens	5	164
95 latrines, in use	4	91
14 latrines, old closed	0	14
5 post exchanges	0	5
4 mess areas	0	4
4 random cultures	0	4
1 trailer laboratory	0	1
292 Total	9 (3.08%)	283 †

* Each batch contained 15 flies

† All lots negative for pathogens, but positive for *E. coli*, *Paracolon*, and *Proteus*

Cultures of Flies Collected in Representative Mess Areas, Latrine Areas, and Post Exchanges in the Entire Bivouac Area—In the first 2 weeks of October (during the decline of the epidemic), 292 different lots of flies were collected from sources as outlined in Table 5.

Each lot consisted of approximately 15 flies. These were identified as the common housefly, *Musca domestica*. Of the 292 lots, 9, or 3.08 per cent, yielded *Shigella paradysenteriae*, Boyd 88. Five of these positive lots came from field mess areas and 4 from latrines in active use. One of the most significant findings in the fly culturing study was that, although flies were breeding in great abundance, none of the flies from the closed latrines, when cultured, were found positive for pathogenic organisms.

SPECIAL CONTROL MEASURES

Elimination of Flies—In addition to the sanitary control measures already in force, special measures were taken to bring the fly breeding under control: (1) The covering of the old latrines with heavy paper, which was packed down by 3–4 inches of oiled sand, was effective in preventing egress of fly larvae. (2) The straddle trench type of latrine was supplanted by the deep pit type, covered by fly-proof boxes. (3) Trained orderlies were placed on duty to maintain the proper oiling, fly-proofing, and upkeep of the latrines. (4) Attention was directed to the training of soldiers to utilize the latrines.

Protection of Food from Flies—The screening of messes was instituted to protect food while being prepared. Flies in the messes were eliminated by swatting, spraying, and the use of fly paper and fly traps.

Elimination of Sources of Infection—An attempt was made to eliminate the sources of infection in the usual manner by the early detection and isolation of cases. In addition, a study was made to evaluate sulfasuxidine *

* Sulfasuxidine given as prescribed by Sharp & Dohme.

and sulfaguanidine * in the treatment of carriers in the field. One hundred and twelve positive convalescents were given sulfaguanidine, 132 sulfasuxidine, and 60 remained as untreated controls. Cultures were taken on all cases at weekly intervals for 3 weeks. Negative cultures were obtained at all times after treatment with either sulfonamide, whereas the controls remained positive in approximately the same percentage as shown in previous tables. Thus, either drug appeared to be effective in relieving the carrier state.

SUMMARY

The following is a summary of the findings of this investigation:

1. A large outbreak of 1,557 cases of bacillary dysentery occurred in which *Sh. paradysenteriae*, Boyd 88, was found in 91.6 per cent of the organisms isolated.

2. The onset of the epidemic was about 2 weeks after troops had moved into a bivouac area in which flies had begun to breed in large numbers because of improperly operated straddle trench latrines.

3. The epidemic was gradual in onset, widespread in distribution, reached its peak in about 2 weeks, and declined simultaneously with the gradual disappearance of flies.

4. The predominating organism isolated from the dysentery cases, *Sh. paradysenteriae*, Boyd 88, was cultured from 9 lots of flies collected in the kitchens and operating latrines.

5. In one unit sent away from the bivouac area for training, no further cases of dysentery occurred after 48 hours.

6. The rate of asymptomatic infections or carriers in 443 food handlers was 10.8 per cent. This would appear to indicate that a state of immunity does exist against the causative organism for the disease.

7. The importance of the common housefly in the transmission of bacillary dysentery should be stressed more than it has been in the past, and corresponding attention should be directed to its control.

* Sulfaguanidine given as prescribed in *Circular Letter 56*, Office of the Surgeon General, War Department, Army Service Forces, Washington, D. C.

NOTE

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PHYSICIAN, POLICEMAN, OR PEDAGOGUE?

WITH the elimination of water supplies and milk supplies as causes of large-scale community epidemics, the control of food handling in the store and the restaurant has become the most important factor in the control of alimentary infections in most American cities. The return from African and South Pacific service of hundreds of thousands of carriers of the germs of amebic and bacillary dysentery will make this problem one of major significance in the next few years.

There are three different correlated approaches to the control of food-borne infections. The first of these is the medical approach, the attempt to eliminate sources of possible infection by routine health examinations of food handlers. This procedure has serious limitations in the opinion of thoughtful health administrators. The infectivity of individuals varies from week to week and from day to day; and no system of examination can protect against the transient positive throat culture or the temporary staphylococcus infection on the finger. Routine health examinations have been defended by some as aids in the general community program for finding cases of syphilis and tuberculosis. The place to find new cases of syphilis and tuberculosis, is, however, among the contacts of known cases; and routine examination of random population groups has been rightly described as "a slipshod substitute for intelligent epidemiology." It may well be desirable to insist on stool examinations for servicemen returning from the tropics who desire to serve as food handlers. As a general basis for the control of food-borne disease, however, medical supervision is not the answer.

A second approach to the solution of this problem is to be found in law enforcement. This is obviously an essential part of the program. Codes of cleanliness for food handling establishments, licensing of such establishments, regular and conscientious inspection service, must be available for effective control. Yet all this is not enough. The policeman, like the physician, can only visit a given restaurant at relatively infrequent intervals; and much may happen between visits.

What we really need for effective control is an inspector on the ground every

day and every hour of the day; and to approximate such an ideal we must invoke the forces of education. No proprietor or responsible administrator desires the scandal of an epidemic among his customers. There is no real diversity of interests here, only the need for enlightenment and motivation. The major purpose of each inspector's visit should be the enlistment of informal deputies on the spot who can note deviations from sanitary practice in the day's routine—who can detect the waiter with a cough, the pastry cook with an infected finger. The Memphis food handlers' school [1] which, through an eight day course of instruction (conducted with the coöperation of the local Restaurant Association and Chamber of Commerce), reached 25 per cent of all food-handlers in the city, and the school at Miami, conducted by the Dade County Health Department [2] are excellent examples of progressive public health control. By the aid of such special devices and by making every contact of the physician and the sanitary inspector primarily an educational contact, our program of food sanitation can be made truly effective.

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THE HEALTH COUNCIL AND ITS POSSIBILITIES

THE building of sound health programs for our local communities is too important to permit of any waste of effort or duplication. Every city of any size has a multiplicity of groups concerned with one or another phase of public health—official health departments, private health agencies, clinics, hospitals, and professional organizations of physicians, dentists, and nurses. Working together in a health council with full understanding of each other's programs, they can attain maximum results with limited staffs and funds. Such a council can serve as a forum for discussion of health problems, a medium for continuing analysis of community needs and for stimulating ways of meeting them, a means for avoiding duplication and friction, machinery through which citizen participation can be made effective, and sound community health programs can be formulated and kept up to date.

When competently directed, the health council has proved its worth. Operating, usually, as a division of the Community Chest or Council of Social Agencies, the council functions most effectively when it has a considerable measure of autonomy, its own paid staff, and a reasonable budget. Without these, it has little chance of success in any sizeable city. With them, it can be an effective ally of the official department and a strong unifying force for promoting public health.

When Dr. Haven Emerson made a critical analysis of the Cincinnati Public Health Federation at its own request several years ago, he termed it the "Community's Conscience in Health Matters." Having the confidence of the Health Departments of the City and County, the faculty of the College of Medicine, the Academy of Medicine, the Dental Society, the Graduate Nurses' Association, and the backing of the Community Chest, this Federation has admirably demonstrated the effectiveness of sound coördination.

All health agencies, public and private, and the appropriate professional

organizations, as well as social and civic agencies with a direct interest in public health, are represented in the Federation's delegate body. This group elects the officers and twenty-five members at large who, with the health commissioners of the City and County and the chairmen of the thirteen councils, make up a Coördinating Committee—the active governing body of the Federation. The 500 citizens, who participate in the Federation's work as delegates or members of one or another of its thirteen councils, constitute its greatest strength.

Each of the Federation's Councils is made up of organizations and individuals active in its particular field, and develops its own program subject to the approval of the Coördinating Committee. Ten of the Councils—Cancer Control, Child Hygiene, Clinics, Diabetes, Health Education, Heart, Mental Hygiene, Mouth Hygiene, Community Nursing, Nutrition—were organized as divisions of the Federation. Their activities consist primarily of coördination, education, and programming. The Anti-Tuberculosis League, the Better Housing League, and the Social Hygiene Society have been recognized as the Federation's Councils in those fields.

The Federation has fought consistently to strengthen the official Health Departments which it considers the most important cog in the community's public health machinery; it has initiated and stimulated and coördinated programs for cancer control, diabetes, heart disease, enteritis, and appendicitis; through the joint efforts of diet specialists, it has carried on an effective nutrition program; it has organized a sizeable and effective Negro health clinic where Negro doctors and dentists had their first local opportunity for participation in clinic work; it has launched a strong centralized mental hygiene clinic; it has been influential in having a children's orphanage transformed into a much needed children's convalescent home.

Coöperating with the Anti-Tuberculosis League, the Federation secured a $2,000,000 bond issue which built the County's modern Tuberculosis Hospital. It conducted, through a special Citizens' Committee, a successful bond issue campaign for $3,500,000 to construct a new County Home and Chronic Disease Hospital which is in the blue print stage ready for building as soon as the war ends. It likewise conducted a $1,500,000 bond issue campaign which will result in important improvements in the City's General Hospital when critical materials become available.

The Cincinnati organization maintains continuing studies of resident mortality by age, sex, and race groups, and makes a comparative analysis of mortality in thirteen comparable American cities. The first published report of these studies for three years, 1929–1931, was widely publicized and led to notable changes of emphasis in the local health program. Similar studies for the period, 1939 through 1941, are being completed and will be published within the next few months.

Due to its recommendations, some local health agencies have voluntarily modified their activities, others are making changes, and two have transferred their work to tax support.

A good example of teamwork is a program of health education sponsored jointly by the Health Department, the Academy of Medicine, and the Federation. The program consists of car cards in buses and street cars, a series of monthly posters in factories, several regular radio programs, daily or weekly health series in two of the large dailies and in suburban papers, exhibits, monthly bulletins for Parent-Teacher Associations, and periodical nutrition bulletins for

families of low income. The health messages prepared and distributed in a single year would fill eight or ten fair-sized books. Health education is an especially logical activity for a health council because its scope embraces the whole field from dental to mental health and because official departments usually find it difficult to secure funds for effective education and publicity.

Concentrating its efforts on health problems related to the war, the Federation initiated a Consultation Service for men rejected at the local Induction Center and is now conducting psychiatric screening of registrants in coöperation with Selective Service. It has played an important rôle in the effort to reduce unnecessary demands upon physicians and nurses and in promoting enrollment in schools of nursing.

The Federation's work is financed principally from Community Chest appropriations. Its staff consists of an Executive Secretary who is also the Head of the Better Housing League, an Associate Secretary (a physician who serves also as Director of Research), a Health Education Assistant, and two volunteers. One of the volunteers gives full time and does a remarkably efficient job as Assistant Secretary. The other volunteer, who devotes most of his time to the work, is a distinguished authority on advertising technics and is the Federation's President.

Cincinnati is cited as an example because it has one of the oldest of such coördinating health agencies. Other leading Councils, such as those in Cleveland, Boston, Louisville, Chicago, or Philadelphia, would have served as well. Health councils are now functioning in about fifty cities. Unfortunately, many of them are weak and ineffective because they lack funds and leadership. There is no magic in the word "health council." Only if such a council has vigorous, intelligent direction and financial backing can it develop effective teamwork in the health field.

Medicine and the allied sciences have given us powerful tools for health building, of which no community is making the fullest use. The health council is one means by which citizens and community health forces can unite to make such tools effective.

EVALUATION OF CLINIC NURSING SERVICE

THE health administrator should be keenly interested in the intensive survey of Public Health Nursing Services in Clinics sponsored by the N.O.P.H.N. Committee on Nursing Administration. This study covered 212 clinics and health conferences of various types (child health, crippled children, maternity, tuberculosis, and venereal disease) in 38 states—a very representative sample. As a basis for the survey, lists were drawn up of 27 activities which might be performed in preparation for the actual clinic session, 105 activities which might be performed during the session, and 15 activities which might be performed after the session. The lists of these activities were then submitted to a jury of public health administrators, physicians, and public health nurses for the selection of those functions which should be performed by the public health nurse and in this way two pre-clinic, seven clinic, and four post-clinic activities (with other functions in certain special types of clinics) were defined as among the primary tasks of the public health nurse. This standard was then checked against actual practice in the 212 clinics studied.

The basic duties so selected were chiefly concerned with two fundamental functions—direct personal contact with the patient and health education. These are the two things which only the trained public health nurse can most effectively accomplish. They differ of course with different types of clinics. In the case of child health there were 18 public health nursing functions, 14 of which were actually performed by nurses in 50 per cent of the clinics studied. In the case of crippled children's clinics, only 7 out of 16 functions were actually performed by public health nurses in 50 per cent of the clinics. Maternity clinics showed 9 out of 13 functions so performed; tuberculosis clinics, 10 out of 15; venereal disease clinics, 6 out of 16. Clearly many tasks which should be accomplished by the public health nurse are either not being performed at all or are being delegated to less competent personnel.

On the other hand, the nurses in these clinics are devoting much of their time to many other activities not accepted as essential public health nursing functions—to duties such as preparing examining tables, distributing and caring for linen, recording weights, making out reports, and cleaning up equipment, which could quite as well be performed by nurses without public health training or by volunteers or paid assistants.

Assuming—as we must—that the primary purpose of the health clinic or conference is an educational one, it is clear that the practices revealed by this study not only represent a serious waste of professional time but also involve failure to attain maximum results from the procedure as a whole. It is the responsibility of the public health administrator, first, to secure well qualified public health nurses (only 32 per cent of those found functioning in the present study had completed a special program of study in public health nursing and only 53 per cent had had prior public health experience); and, second, to organize the service so as to use appropriate personnel for each particular task.

We have only touched on the highlights of this N.O.P.H.N. report, which contains not only analysis of various clinic functions but very suggestive time-study data. The entire report should be read to obtain its full value.[1] Above all, health officers and directors of nonofficial health agencies would do well to obtain from the N.O.P.H.N. copies of the appraisal schedule used and to evaluate the organization of the clinics and conferences for which they are responsible by the excellent procedure here developed.

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Industrial Sanitation

Engineering Section

IT is universally realized that war production is the very core of our nation's offensive action, and will remain a paramount duty until the war ends. Experience during the first year and a half of war has clearly shown that the worker himself is the most important factor in getting out production. Since we have practically reached the limit in the size of our labor force, we are therefore faced with the increased necessity of effectively utilizing and conserving all of our man power resources. Industrial hygiene services have a major part of the responsibility in meeting this challenge by assisting industries in the prevention of illnesses and deaths from industrial poisons, and in the maintenance of physical fitness of all workers. It goes without saying that in the field of industrial hygiene the engineer has a major contribution to make.

Estimates made by the War Manpower Commission show that of a total labor force of nearly 63,000,000 persons (including the armed forces), something like 38,000,000, or 60 per cent, are in the armed forces or engaged in activities essential to the war. Aside from the large numbers involved, the industrial hygienist's task has been made even greater by the fact that the labor force itself has changed materially. This tremendous change in the make-up of the working force is of utmost significance, both in military service and in war production for even these largest consumers of man power are employing women, adolescent boys, the aged, and the handicapped. Furthermore, when we speak of man power today we inevitably must include all of us—the professional and technical personnel responsible for production and for health and safety; the supervisory personnel; the workers themselves. This altered labor force, the speed-up associated with production, longer hours of work, and the increase in exposure to many hazardous materials and conditions, have all augmented the task of the industrial hygienist. Furthermore, because the industrial hygienist has done a good job in the field of occupational disease control, he has had thrust upon him more problems, not only in number, but also in variety. Unfortunately, the task force in industrial hygiene has not materially increased for handling these greatly increased responsibilities.

Prior to the war considerable progress had been made in the establishment of industrial hygiene services throughout industry, and in official and nonofficial agencies. Large industrial establishments had begun to employ physicians, engineers, and chemists for specific work in the field of preventive medicine. Nonofficial agencies, such as insurance companies, universities, and foundations, had also established industrial hygiene services. Perhaps the greatest impetus to industrial hygiene in official agencies was given by the

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COMMITTEE ON INDUSTRIAL SANITATION
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federal government when it began to allot funds for this work under Title VI of the Social Security Act. At the beginning of the war more than 30 states and several cities had established industrial hygiene services within their health departments. Only the armed services had made no provision for industrial hygiene except in a very limited way.

When the President declared a state of emergency in 1940, the various governmental agencies became more active in this field. The Army and Navy established industrial hygiene sections in their respective divisions of preventive medicine, while the Public Health Service started to expand its task force as early as 1940. It was not until May, 1942, that the U. S. Maritime Commission began to interest itself in the industrial health field. By the time war was declared there were approximately 500 industrial hygiene personnel in the country, exclusive of physicians in the practice of industrial medicine.

At the very beginning of the national defense program, the U. S. Public Health Service, through the Division of Industrial Hygiene, National Institute of Health, was asked by the Subcommittee on Industrial Health and Medicine of the Office of Defense Health, and Welfare Services to assume leadership in coördinating a nation-wide industrial hygiene program. In view of the fact that the Division of Industrial Hygiene had developed over the years, in coöperation with the various states, a nation-wide industrial health program, it offered its facilities, both in the field of research and direct services, to the War and Navy Departments. Before outlining how such a coördinated program has been developed through the present emergency it may be well to discuss briefly the responsibilities of the various agencies in the war program.

Navy Program

The U. S. Navy Department, aside from the men of military status, has the responsibility for the conservation of health of nearly 750,000 Civil Service personnel employed in approximately 700 naval stations. In order to meet this responsibility, the Navy Department created a Section of Industrial Health in the Division of Preventive Medicine of the Bureau of Medicine and Surgery. This Section of Industrial Health, in collaboration with the Office of the Assistant Secretary of the Navy, attempts to control the industrial environment in Navy shore establishments by analyzing occupational disability reports and by making recommendations in regard to the detection and elimination of potentially hazardous working conditions; by preparing information on various hazardous materials and processes; and by coordinating the efforts of the industrial hygiene field personnel.

To achieve these objectives, the Navy has a staff of more than 50 medical officers and 40 industrial hygienists, many of whom are engineers. These men have received postgraduate instruction in industrial hygiene and are now on assignment at the various Navy shore establishments attempting to solve the problems of lost time due to illness and injury, to increase production and efficiency, and to promote morale among the employees.

In the Navy industrial hygiene program the Office of the Assistant Secretary of the Navy is responsible for accident prevention, while the Section on Industrial Health in the Bureau of Medicine and Surgery is responsible for the protection of the general health of Navy industrial personnel. Although these functions are administered separately, they are very closely correlated. For example, the medical officers undertake the study of health hazards associated with occu-

pational activities, the conduct of technical surveys to determine potential or existing exposures, and the laboratory analyses necessary to evaluate such exposures. These observations and recommendations are made available to the safety officer, who is responsible for the application of the necessary control measures.

The Navy Department safety engineer serves as adviser to the Director of the Division of Shore Establishments. This division develops the standards for safety protective equipment used by the Navy stations and is responsible for the development of general safety rules for shore establishments of the Navy. The various Navy Department safety engineers make frequent field surveys of naval shore establishments and serve in a technical advisory capacity in problems of safety engineering. At each establishment a naval line officer is designated as safety officer and is responsible for the administration of the accident prevention program. He may be assisted by a junior line officer, and one or more civilian safety inspectors. At the present time the Navy has approximately 500 such safety personnel.

The Section of Industrial Health, on the other hand, serves in a liaison capacity to the other bureaus of the Navy Department, to the Maritime Commission, and to various nonofficial agencies. The Section also serves the seagoing Navy by aiding in the establishment of proper control of its industrial hygiene problems.

MARITIME COMMISSION PROGRAM

At the present time the U. S. Maritime commission is responsible for a working population of approximately 1,200,000 persons employed in Maritime and Navy contract yards. This does not include government-operated Navy yards. In general, the health and safety programs in these yards follow very closely the recommendations laid down jointly by the U. S. Maritime Commission and the U. S. Navy Department in the minimum standards developed by these agencies.

The Maritime Commission has an industrial hygiene force loaned to it by the Navy Department, consisting of 3 medical officers functioning in the Atlantic Seaboard, Gulf Coast, and Pacific Seaboard regions, and 8 nonmedical industrial hygiene officers, of whom some are engineers. The Great Lakes region has 1 engineer officer, but no physician. There is also a safety officer in each of these four Martime Commission regions. All this work is coördinated under a Chief Health Consultant, coöperating closely with a Chief Safety Officer.

It may be seen from this brief description of the Martime Commission program that the few personnel it has on industrial hygiene are primarily employed in a consulting capacity. Any technical studies which are needed in these yards, are, as a rule, performed by the various state and local industrial hygiene units in which the yards are located. More information on this phase of the work will be presented in the appropriate section of this report.

WAR DEPARTMENT PROGRAM

The Surgeon General of the Army was given the responsibility of overseeing the health of workers in all government-owned plants but the actual inspection of them was divided between that official and the U. S. Public Health Service. Those plants owned and operated by the government receive inspection by Army personnel. There are approximately 550 such plants employing roughly 800,000 civilians, all of whom are on civil service. These establishments include manufacturing plants—Ordnance, Chemical Warfare, Signal Corps, and Quartermaster Corps; fabricating and repair plants—

Ordnance, Air Force, and Chemical Warfare; explosives plants, bomb loading, shell loading, fuse and booster types—Ordnance and Chemical Warfare; while cargo shiploading plants come within the purview of the Ports of Embarkation.

In order to handle the problems in these plants operated by the government, the Surgeon General's Office has established an Occupational Hygiene Branch in its Division of Preventive Medicine, which has two medical officers and one engineer officer at its headquarters. The Occupational Hygiene Branch maintains a laboratory, whose personnel consist of 2 medical officers and 18 engineers. There are also in each Service Command and each Air Service Command an industrial medical officer and, in some, an engineer officer. The Army also attempts to maintain in all of its larger plants medical officers and in some cases engineers. There are, of course, in all of these plants contract surgeons and Civil Service physicians doing industrial hygiene work. All told, there are 120 medical officers, 60 contract surgeons, and about 20 Civil Service physicians for this type of work.

In the second category of War Department plants are those which are owned by the government but operated under contract. Although these too are a responsibility of the Surgeon General's Office, the Division of Industrial Hygiene, National Institute of Health, acts as the agent for the Surgeon General's Office of the Army in the inspection of these plants. There are several hundred of these plants employing approximately 750,000 workers. They are our largest producers of the tools of warfare. The Public Health Service constantly maintains in the field three inspection crews, each consisting of 1 general physician, 1 physician-dermatologist, 1 engineer, and 1 chemist. In addition, the necessary supporting laboratory personnel for these crews are maintained at the Division's laboratories at the National Institute of Health.

For the purpose of coördinating the inspection work of the Public Health Service with that of the Army, an industrial hygiene unit was established at the Chicago headquarters of the Safety and Security Branch, Office of the Chief of Ordnance. A medical officer from the Army and a medical officer and an engineer officer from the Public Health Service have been assigned to this unit which initiates plant surveys, as needed, by personnel of the Public Health Service and of the Army Industrial Hygiene Laboratory. The unit also maintains general supervision over these activities, reviews critically the reports resulting from these surveys, makes follow-up visits to ascertain the effectiveness of control methods, and gives consultation on the most practicable methods of putting recommendations into effect.

Among other functions of this coordinating unit may be listed the development and promulgation of standard codes of medical services and engineering control of health hazards; the dissemination of new information; the review of safety audits made by the safety inspectors of the Ordnance office. From time to time meetings of plant physicians and engineers working in government plants have been held with the medical and engineering personnel of the Office of the Surgeon General of the Army and the Public Health Service.

PUBLIC HEALTH SERVICE AND STATE PROGRAMS

The above review of the Army program serves to describe an important part of the field work of the Division of Industrial Hygiene. No attempt will be made in this report to discuss the research work which is one of the

major activities of the Division. The other wartime industrial hygiene work of the Public Health Service is intimately concerned with the activities of the various state and local industrial hygiene units. It is through these units, in coöperation with the Public Health Service, that services are provided for the third type of plant engaged in the production of war materials, namely, the privately owned, privately operated plants, of which there are a great number and variety.

In 1940, the majority of state and local industrial hygiene units had merely skeleton forces, even for peacetime needs. The staffs usually consisted of a physician, an engineer, a chemist, and occasionally a nursing consultant. Only a few large industrial states, such as New York, Michigan, Pennsylvania, and Connecticut, had larger staffs, and even these were too small to begin to meet the needs confronting them. Furthermore, the state units immediately felt the inroads made upon them by the recruiting program of the armed services. In fact, most of the industrial hygiene personnel mentioned previously in this report as being attached to the Army and Navy, came from the state units.

The Public Health Service began recruiting and training personnel early in 1941, and obtained many of its men from the general public health field. In a few instances it has given Reserve commissions to state and local personnel, by arrangement with the respective state health commissioners.

At the present time, the total force of the state and local units consists of 46 physicians, 141 engineers, 22 nurses, and 45 other professional personnel, such as chemists. Of these 254 professional personnel, approximately 60 are on loan from the Public Health Service.

Some idea of the inadequacy of the present industrial hygiene forces in the states can be obtained from a brief summation of the new responsibilities given these states and their accomplishments. For example, the War Manpower Commission is calling upon the Public Health Service, and through the Service upon the states, for the inspection of many private war plants to determine whether conditions are such as to warrant the release of men from some plants to others, because of alleged poor working conditions. A striking example is the high "quit" rate in the aluminum refining industry, where workers claim that unhealthy conditions in pot rooms make it difficult to work safely and efficiently. It is up to the Public Health Service and the states in which aluminum refineries are located to study these working conditions and render reports for the guidance of the local offices of the War Manpower Commission.

Again, the War Production Board has established more than 2,500 labor-management War Production Drive committees and has urged all of these committees to become active in the field of health and safety. These committees are calling more and more upon the Public Health Service and the state industrial hygiene units for advice and services.

The Provost Marshal General's Office, which has responsibility for internal security in all war plants, has recently arranged with the Public Health Service for the routine inspection by the state and local units of many private facilities coming under the jurisdiction of the Provost Marshal General's Office. Similar arrangements have been made with the Chief of the Office of Ordnance for the inspection of private facilities, and lately with the U. S. Maritime Commission for the inspection in the interest of health of several hundred shipyards located in 28 of our states.

No attempt will be made to cite the

various accomplishments of the federal forces, except to indicate that not only have all of the plants now in operation received initial inspections, but some have been surveyed several times. It is also gratifying to note in passing that as a general rule recommendations made by the various inspecting crews are put into force quickly. In so far as the state units are concerned, some idea of the extent of the ground covered may be obtained from a recent summary made by the U. S. Public Health Service for the fiscal year 1942. Approximately 6,000 establishments employing nearly 3,000,000 workers were covered by the state and local units in that year.

It is evident that although a nation-wide coördinated industrial hygiene program exists, and although it is performing a difficult task heroically, still the amount of services rendered is far from adequate if we are to aid in maintaining work schedules and production by reducing lost time due to disability. It is therefore of paramount importance that everything possible be done to retain present personnel at their posts in the states. The Advisory Committee for the Procurement and Assignment of Sanitary Engineers of the War Manpower Commission recently revised its criteria for essential sanitary engineers in order to give more adequate consideration to those engaged in industrial hygiene work. The new definition of essentiality for industrial hygiene engineers takes into consideration the working population in each state, thereby insuring in nearly every instance that present forces will not be depleted.

FUTURE CONSIDERATIONS

This report has attempted to present the highlights of the industrial hygiene program of official agencies in the present war effort, and the responsibilities involved in the maintenance of the health of our war workers. The manner in which the industrial hygiene program has been organized, developed, and carried on has also been briefly depicted. Those developing this nation-wide program attempted to accomplish a dual purpose: (1) to meet quickly and effectively the demands on industrial hygiene services created by the war production program, and (2) to create an organization which would function in the peace years as well as in the war emergency. The program was developed on a sound and permanent foundation with the realization that the need for industrial hygiene after the war will be even greater than it is today. Many of our problems may be similar in character, but they will certainly be wider in scope.

To mention but a few of the problems in industrial hygiene which will confront this nation, one should list such items as the problems created by the return of service men to their former jobs; programs for men let out of war industries, for the reconversion of these industries to peacetime production; plans for rebuilding cities and terminals; new transportation facilities; research; and services in the fields of health, nutrition, medical care, education, and recreation. There will be the important problems of rehabilitation, both physical and vocational, of our fighting army, as well as our army on the production front. Plans are even now being considered for broadening the scope of social insurance, for labor and its participation in the new expanding economy, including not only working conditions, rates and hours, but also relations with management and the consumer, and the training of new skills.

These and many other problems which will confront us in the peace years should be the concern of industrial hygienists. In order to meet them effectively, however, we should begin

now to train additional personnel and to provide additional funds for these programs. We shall certainly be better prepared to meet these post-war problems in industrial health than ever before. By the end of this war, through the efforts of all the agencies now engaged in industrial hygiene work, more professional people will find themselves versed in industrial hygiene skills. Management, labor, and the public will have come to accept industrial hygiene as commonly as they now accept other health services. Legislation will need to be extended and made more uniform in order to protect the working population against industrial health hazards, while emphasis on industrial health services in the small plants will need to be considered and extended.

Only a few of the problems and opportunities which will confront the industrial hygienist after the war have been mentioned. To make sure that these future activities receive proper guidance and implementation, those who have the knowledge and the responsibility in the field of public health must accept the challenge and begin now to take part in the planning. Engineers have a major rôle in this planning. They have never been lacking in vigor, vision, and the knowledge to take the initiative; and both labor and management will welcome our taking our rightful place. This will all be possible because, as already indicated, the present wartime industrial hygiene program has been built not as a temporary expedient but on a firm and solid foundation.

W. SCOTT JOHNSON, *Chairman*
JOHN BUXELL
A. H. WIETERS
SOL PINCUS, C.E.
A. H. ZIMMERMAN

Wartime Shellfish Problems*

Engineering Section

ON account of the war, only those members of the committee who were able to attend the annual meeting of the National Shellfisheries Association, met at Philadelphia in June, 1943. A few other persons interested in the technical and scientific problems of shellfish sanitation attended.

It was the consensus of opinion of the committee members that because of the man power shortage and scarcity of materials needed to keep plant and equipment at par, normal sanitary standards would be more difficult of attainment during the coming season than is normally the case, and would become more difficult the longer the war continued. For this reason, it was agreed that the vigilance of all those responsible for the cleanliness and safety of shellfish needed to be redoubled. Although additional vigilance is called for, unnecessary refinements, yielding little or no additional protection to shellfish consumers, should not be suggested in wartime when normal supplies of materials and labor are lacking. It was agreed that a progress report recounting the present status of shellfish sanitation and inviting attention to the problems still confronting the shellfish regulatory officials and the industry would be desirable. This report is therefore presented.

Since in many shellfish producing states, it is the responsibility of sanitary engineers to decide which areas shall be closed, and since wide divergencies appeared in conclusions reached as a result of sanitary survey and as a result of laboratory examination, this committee, in its 1936 report, invited attention to the need for a more satisfactory bacteriological check on the safety of shellfish offered for human consumption and also for a reëxamination of the bacteriological methods employed in checking the safety of shellfish growing areas from which shellfish might be marketed without further processing. Such studies were begun by the Public Health Service but were interrupted by the war.

A committee from the Laboratory Section of the Association at its 1942 meeting recommended, and the Association has recently adopted [1] a suggested method for the examination of shellfish. Important modifications of the methods recommended by the Association in 1912 have thus been made. It will be interesting to many, and important to the shellfish industry, to see whether closer correlation between results found on laboratory examinations, as obtained by following the new standard methods, and the results obtained by sanitary survey can be attained. It will also be interesting and important to see whether oysters, soft clams, hard clams, and mussels will show equal degrees of contamination when taken from the same growing areas, and whether real significance can be attached to results obtained from the bacteriological examination of shellfish

* Progress report of the Committee on Shellfish.

COMMITTEE ON SHELLFISH (Engineering Section)
Organized 1928. Published reports: *Year Books* 1934–1935, 1935–1936, 1936–1937, 1937–1938, 1938–1939, 1939–1940, 1940–1941.

found on the markets of interior cities. These are some of the problems still confronting regulatory officials and the shellfish industry.

In addition to these, there are special problems of sanitation brought on by wartime conditions, some of which are discussed briefly below.

SOME OF THE WARTIME PROBLEMS

1. Changes in boundaries of closed shellfish areas have become necessary in certain areas because of increasing quantities of sewage partially treated or untreated, discharged into nearby shellfish growing areas due to the concentration of war workers in coastal areas, near shipyards, or at marine, military, or naval bases.

2. Finding suitable container material for shucked shellfish to take the place of tin has become a problem for packers of shucked shellfish and regulatory officials.

3. Evaluating the effectiveness of shellfish sanitation measures more carefully and more scientifically than heretofore has become of prime war time importance because of man power shortages.

4. Methods to encourage greater production and consumption of shellfish foods have brought new problems to areas where mussels are being harvested and to areas where intensive cultivation of oysters and clams are being employed.

The Army's inclusion of sea food as a portion of the diet of troops has tended to intensify these problems so that members of the shellfish industry have urged regulatory authorities to remove restrictions on contaminated areas to make it easier to meet increased demands.

1. Changes in boundaries of closed shellfish areas—The great expansion of military, naval, and industrial areas along the coast on salt water estuaries or tributaries has, in some instances, made it necessary to close large areas of productive shellfish grounds because of increased quantities of sewage being discharged into waters tributary to such areas. The movement to reduce the pollution of large bodies of coastal waters was making good progress when the war broke out. The demands of the war for ferrous materials practically put a stop to the use of such materials in sewage treatment projects, except in those projects essential for the protection of public health. The result has been that sewage treatment projects needed for normal civilian population increases have been almost impossible to obtain.

In view of the increasing importance that attaches to the efficient production of food for ourselves and our Allies, it does not seem unreasonable to your committee to expect that reasonable quantities of critical materials should be released by WPB for sewage treatment works where increased quantities of sea food could thus be made available. Since shellfish are good substitutes for meat which is very much needed in the war effort, and since they are sources from which important food elements needed by the body can be obtained, it seems reasonable that their production should be fostered in times of food shortages such as now prevail. The oyster crop now is equivalent in food value to about 400,000 dressed steers yearly.

2. Experiments with various materials seem to indicate that containers made of black steel, coated with a suitable coating, are the best substitute thus far found for packing shucked shellfish. It appears to be better suited for containers of shucked shellfish than either glass or heavily paraffined fiber, since it is a close imitation of the tin cans so extensively used heretofore in the industry, and can be used with machinery now installed in packing plants.

3. Evaluating the effectiveness of necessary shellfish sanitation measures in such a way as to disclose accurately the degree of compliance with sanitary requirements improves the efficiency of control measures. In times of man power shortages, maximum efficiency is essential.

A short time prior to his death, Leslie C. Frank suggested that the same principles used in developing milk sanitation programs could be used effectively in shellfish sanitation practices. These principles are, briefly:

1. The sanitary requirements must be accurately stated.
2. The public health reason to justify the requirement must be given.
3. A clear statement of what constitutes satisfactory compliance must be enunciated.
4. If the relative importance of each requirement can be indicated by assigning a weight which is commensurate with the importance of the requirement, then the percentage of compliance attained can be approximately expressed with a single figure, e.g., 60 per cent, 80 per cent, 90 per cent, etc.

The preparation of a manual of shellfish sanitation requirements, based on the above principles, was begun before the war. Some of the members of the committee have participated in its preparation. It seems probable that the manual may be put to an unofficial trial during the present shellfish season, and constructive criticism can thus be invited before it is officially adopted as a guide for determining compliance with requirements. It is believed that the use of this manual will add to the efficiency and effectiveness of the work of shellfish inspectors, will tend to bring about uniformity of enforcement throughout the entire shellfish industry, and will gradually bring about a correction of insanitary conditions. Those interested in obtaining a copy of this shellfish manual should write to the Surgeon General, U. S. Public Health Service.

4. Methods for increasing the production of shellfish foods—These methods fall under four principal heads: (a) the wider utilization of mussels; (b) the exploitation of deep sea shellfish areas, such as deep sea clam areas; (c) the more intensive cultivation of inshore shellfish areas both for oysters and for clams (An intensive method of oyster culture recently demonstrated in America is described in this report.); (d) the purification of shellfish from moderately contaminated areas and the transplanting of shellfish from such areas into clean waters.

The wider utilization of mussels on the Atlantic and Pacific coasts calls for increased vigilance in avoiding cases of mussel poisoning. Two wholly different types of mussel poisoning occur. One apparently occurs only in the California mussel *(Mytilus californianus)*. A wholly different form of poisoning may occur from eating the Black Sea mussel *(Mytilus edulis)* now being widely advertised. It is claimed that it is dangerous to eat black mussels which are so far gone that their shells gape. Fisheries and market inspectors should be warned to be on the lookout for gaping mussels and to warn the trade to be careful not to include such mussels in shipments or in the retail trade. Mussels are sensitive to high temperatures; hence it is even more important to store and ship them at low temperatures than is the case with clams or oysters.

Cases of mussel poisoning occurring on the Pacific coast have attracted the attention of scientists for many years. Methods for determining the presence of the chemical poison responsible for causing the illness have now been developed.[2] Sufficient study has been directed to the problem of mussel poisoning to indicate that the trouble is seasonable and is apparently due to the reaction produced by the presence in the diet of a high percentage of

the dinoflagellate *Gonyaulax catenella*. This indicates a method for dealing with the problem.

The utilization of deep sea clams and other shellfish calls for a special method of food preservation and marketing, and does not seem to present any particularly difficult sanitation problems.

The more intensive utilization of inshore shellfish growing areas calls for increased vigilance to avoid accidental sewage contamination of the shellfish. The committee has, in the past [3] made recommendations for dealing with hazards incident to the floating or water storage of shellfish, and its recommendations have been incorporated in the U. S. Public Health Service Minimum Requirements for endorsement of state shellfish control measures and certifications for shippers in interstate commerce. As the intensive utilization of inshore areas increases, the importance of the committee's recommendations for dealing with these hazards increases, since these areas are close to the sources of pollution and are not protected by dilution, because they are located in shallow water.

In recent years, the intensive cultivation of oysters for the half shell trade, by placing them on trays supported a little above the bottom in areas where they are exposed at low tide, has come into commercial use in this country. Modifications of this method have been practised since the early days of the Roman Empire, and by the Chinese for hundreds of years.

The very rapid growth of the oysters, and the extra price obtained for them, may lead to the more extensive utilization of this method of oyster culture in this country as it has in Europe, notably in Belgium and France.

A detailed description of the practice, as employed currently in portions of Virginia, is included here.

Intensive Oyster Culture

Our reason for describing this method of oyster culture in this report is because we are led to believe it can greatly increase our sea food resources at a time when increased food production is important, and to point out certain sanitary precautions which should be observed whenever this method of oyster culture is employed.

The method consists in placing approximately 2 year old oysters, from northern waters, in baskets or trays supported from 6″ to 30″ above the bottom in suitable southern shellfish areas. The oysters are bare or uncovered at low tide, and covered at high tide. In about 6 months, they attain a size equivalent to that of 5 year old northern oysters.

A well established concern in Virginia has been employing this method successfully for 5 years, with remarkable results. Members of your committee have seen the astonishingly rapid growth attained. Dr. Thurlow Nelson, of the New Jersey Experiment Station and of Rutgers University, showed in experiments on the Delaware shores of Cape May, the phenomenal growth and excellent shape that could be obtained. These demonstrations were made about 1920.[4]

Among the factors responsible for the growth are the following:

1. The oysters are in the upper layers of the water, where the temperature is relatively high and the effect of the sunlight produces a plentiful supply of microscopic food, probably of superior vitamin content because of irradiation by sunshine.

2. The shellfish are above the mud and sand where particles of inert material do not become mixed with the food and cause rejection and waste of food. The oyster rejects what is not considered food on the basis of *size of particles*. Consequently, when oversize sand grains or mud particles get

into its food, the mixture is rejected and the slow process of straining food particles out of the sea water must be started all over again. This rejection hardly ever becomes necessary when the oyster is supported above the bottom. Consequently, the amount of food which the oyster ingests is greatly increased and growth is correspondingly more rapid.

3. Northern oysters, when transferred into southern waters, grow very rapidly. Stimulated by the warm water and the abundant food supply, they function vigorously during the 18 hours they are under water, pumping in and expelling from 40 to 80 gallons per oyster per day.

4. During the period when the shellfish are out of water, they learn to adjust themselves to their new environment. The adductor muscle, which holds the shells in a closed position, is strengthened so that oysters grown in this way stand shipment better than oysters which have not been out of water before. The French refer to this as "educating" or "conditioning" the oyster.

5. The oysters are protected from their natural enemies such as starfish, drumfish, and mud worms. If attacked by drills, they can be readily discovered and removed at low tide.

A suitable area must be selected, protected from storms, in shallow water where stringers supported on stakes or piling can be erected so that they, in turn, can support the trays or baskets. There must be freedom from navigation hazards, proper and abundant food for the oysters, and adequate safeguards from the sanitary standpoint.

The importance of sanitation becomes readily apparent. Suitable areas are usually found near land where most contamination originates. They are found near the mouths of creeks, which bring in much of the food and may bring in contamination also; and they are found in shallow water which warms up readily, but which does not afford much dilution of such contamination as may find its way into the area accidentally. The precautions that need to be observed are similar to those recommended for the protection of shellfish growing areas from which shellfish may be marketed directly or for areas used for the water storage of shellfish, except that vigilance should be increased.

Fecal discharges from employees working in the areas should be buried or otherwise disposed of on shore, in a location and in a manner approved by the state health authorities. Approval of the method of disposal should not be left to local sanitarians or to part-time health officers. A special permit, showing precisely the boundaries within which intensive inshore oyster culture may be practised, should be obtained in each instance from the state health department. Without such permit, it should not be allowed.

The low salinity portions of the area can be used for seed production and the higher salinity areas for growing and maturing grounds. This has been the practice in Delaware Bay for many years.

Details of this method as practised in Virginia are as follows[5]:

Welded steel trays that will deliver a bushel of oysters when they have grown to medium size are used. They are 16 x 40 inches in plan, and 3 inches deep. They are dipped into high temperature tar, such as is used to coat the inside of water pipes. That a serious fire which may destroy the coated trays can occur unless care is used, has been demonstrated by experience.

The trays are supported on heavily creosoted wooden stringers, in such manner that there is at least a 6" space between the under side of the tray and the mud bottom below it.

The trays are set out in rows 30 feet center to center. At low tide, small scows are poled between the rows so that work on the trays and the oysters in them can be done from the decks of the scows. Much labor is required. Each of about 250 oysters is placed on the tray by hand, hinge down. They are held upright by a wooden brace placed in one end of the basket. As the oysters expand because of growth, the tray must be repacked in order to maintain the vertical position of the oysters.

The initial capital investment need not be large. It can be profitable only, however, through the production of high grade stock for the half shell trade which will command good prices. The process is not, in its present state of development, suitable for the production of oysters to be sold to shucking houses at presently prevailing prices. The process may have tremendous potentialities for increased food production if so developed that public confidence in the safety of the product is not impaired. It offers a challenge to members of this Section to develop mechanical labor saving devices which will reduce unit production costs and produce a product of unquestioned purity in great volume. If some member of this Section succeeds in contributing a productive idea to this problem, this report will be considered to have been worth while.

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L. M. FISHER, C.E., *Chairman*
MILTON H. BIDWELL
ROY E. DODSON, JR.
JOSEPH B. GLANCY
ESKIL C. JOHNSON
GARDNER LEGG
MAJOR RICHARD MESSER
JOHN H. O'NEILL
SOL PINCUS, C.E.
EDWARD WRIGHT

Nutrition as a Science in Wartime*

Food and Nutrition Section

THE major function of our committee through the years has been to focus attention upon specific areas of research that merit special attention. The present report deals with three topics: (a) the need for certain types of fundamental research through the war period; (b) research that is specifically geared to winning the war; and (c) the need for research that will give a clearer picture of the contribution that nutrition can make to public health.

FUNDAMENTAL RESEARCH DURING THE WAR

In time of war every research program should be critically examined with respect to its demands upon personnel and materials. But such an examination should be conducted with discipline and considered judgment rather than leaving the course of action wholly subject to a natural impulse to drop everything and be off to war.

The following quotation provides a good statement of principle, from President Raymond B. Fosdick's *Annual Report of the Rockefeller Foundation* (1941, p. 7):

> This concern for the future is a matter of stern, practical sense. The specialized talents and abilities that are meeting this emergency and those that will meet emergencies to come are not produced by feverish last-minute activities. No amount of pressure can suddenly create a supply of thoroughly trained and broadly experienced physicists, mathematicians, chemists, biologists, economists and political scientists. These men represent the trained intelligence without which a war cannot be won, or a lasting peace achieved. They emerge . . . out of long, patient, and sustained effort. Pure research, the clean urge to gain new knowledge, the sympathetic appreciation of imaginative scholarship even when it seems remote and unrelated—these we must steadfastly sponsor or our vital intellectual resources will fail us in the days to come.

The science of nutrition is so closely interwoven with other basic sciences and with immediate health problems of the armed forces and civilian groups, that cessation of research, in specific cases, may be too costly in terms of results to justify the transfer of personnel and facilities to immediate war problems. Aid in solving difficult problems relative to personnel deferment has been given in appropriate cases by the Food and Nutrition Board of the National Research Council, through a Committee on Research Personnel, under the Chairmanship of Dr. C. A. Elvehjem.

The following examples may serve to illustrate types of research in nutrition that have been recognized as justified in wartime:

1. Factors that bear closely on blood formation, bone healing, recovery from burns and trauma, shock, and resistance to neuroses

2. Studies of nutrition in relation to chemotherapy, especially with reference to the use of sulfa drugs, arsenicals, and antimalarials

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* Report of the Committee on Nutritional Problems.

COMMITTEE ON NUTRITIONAL PROBLEMS
Organized 1919. Published reports: *A.J.P.H.*, Jan., 1920, Feb., 1921, Feb., 1922, Dec., 1924, Feb., 1926, Dec., 1926, Mar., 1928, May, 1929, Nov., 1929, *Year Books* 1930–1931, 1931–1932, 1932–1933, 1933–1934, 1934–1935, 1935–1936, 1936–1937, 1937–1938, 1938–1939, 1941–1942.

3. Isolation and assay of the less stable nutrients in foods, for example the newer vitamins known to be required by guinea pigs and monkeys, but concerning which little is known with respect to human needs

4. Studies of the minimal and optimal human requirement for amino acids, vitamins and other nutrients that are likely to be deficient in military and civilian wartime diets

5. Relations between nutrition and environment, so that physiological principles can be followed with greater assurance beyond the confines of an air-conditioned room, out into the desert, the arctic, and to high elevations

6. Improvement in certain types of bioassays so that food production, processing, storage, and utilization can be measured with greater accuracy and economy

7. Studies of the nutritive value of foods, in cases where such information is critically important to the national and world need

There should be sober recognition of the fact that no one can predict how long the war will last. Planning for munitions and other war supplies cannot be limited to provisions based upon an assumption that the war will end in 1944. Neither can we limit food production and human nutrition plans to accord with such a simple assumption, however attractive. Leaders in research should be first to recognize that as the length of the war increases, the prospect is heightened that relatively fundamental studies will make important contributions toward winning the war. And in addition we must give some consideration to the contributions that will aid humanity in recovering from the war and in setting their faces toward a brighter future. The hazard is very real that within many organizations research planning during the war will be too short sighted with respect to the assignment and training of man power. Even in planning direct war research there is a similar risk of being wastefully hurried in perspective.

A more specific definition of the areas of research cited above may be helpful.

1. *Recovery from trauma*—The provision of "blood banks" is everywhere acclaimed as a major factor in saving the lives and speeding the recovery of soldiers, sailors, and civilians caught in the immediate physical wreckage of war. Less dramatic but significant contributions to the problem of providing for blood regeneration have also been made during the year, giving a better understanding of procedures that can be used to protect military personnel and civilians. Again, the relation of nutrition to the healing of wounds and bone fractures has been clarified by recent work, and there are strong indications that shock and the tendency toward neuroses may be more severe when there is marginal malnutrition.

2. *Chemotherapy and toxicology*—Numerous publications have pointed toward the need for greater consideration of nutritional status during periods of intensive chemotherapy and exposure to toxic chemicals in war plants. Of special interest are the war-essential nitro compounds and industrial hydrocarbon vapors; yet the evidence that has been presented is so fragmentary that nutrition has been given only minor consideration in many manufacturing plants using or producing such products.

There have been numerous indications, too, that tolerance to intense chemotherapy is conditioned in part by marginal degrees of nutritive deficiencies. There are also scattered indications that intense chemotherapy may cause an accelerated depletion of certain nutrients from the body. In view of the current scale of administering sulfa drugs, antimalarials, and arsenicals, it is evident that the need for additional information regarding nutritional aspects of the problem is relatively great.

3. *New vitamins*—The feeding of troops and civilians on restricted types

of rations that must be processed and packaged long in advance, followed by storage in hot climates, involves practical nutritional problems of major magnitude. The losses in ascorbic acid, thiamin, and other known nuutrients can at least be measured, and they are known to be severe; hence they can be compensated for in some degree by supplying synthetic vitamins. But there is good reason to remember that the vitamin requirements of man have not been critically studied. At least one of the newer factors required by guinea pigs is relatively unstable, but practically nothing is known of its content or loss in special rations, nor do we know whether it is required by man. Information of this nature may be very important if the war lasts through another year or two.

4. *Human amino acid requirement*—There has been world-wide concern over the increasing stringency in supplies of high quality proteins, both for direct human consumption and for animal feeds. In addition to the problem of limited supplies, the problem of cost will assume increasing importance. Even in peacetime there is a constant problem of meeting the need for high quality proteins within the price ranges that can be reached by low income groups. Basically the problem of protein requirement is one of supplying adequate quantities of the individual amino acids; yet the evidence concerning amino acid requirements of man and farm animals has been extremely limited. The finest progress made on this fundamental problem has been carried out since the beginning of the war.

5. *Nutrition and environment*—The whole field of human requirements for specific nutrients, in a quantitative sense, has been very inadequately explored. Most of the fragmentary information available at the beginning of the war was based upon environmental conditions typical of comfortable laboratories, and with subjects that were physically and emotionally "relaxed." Conditions typical of military life in the tropics, ski trooper service, high altitude flying, and submarine life, together with extreme ranges in energy output, fatigue, and nervous tension had scarcely been studied in relation to modern concepts in nutrition.

Since the beginning of the war, several laboratories have undertaken intensive studies in each of the above fields, but most of the reports from such projects have been classified as "restricted" by government agencies, so that a recapitulation of the data cannot be made. It should be pointed out, however, that there are still many gaps in the information available to government agencies, and that qualified research organizations having an opportunity to undertake work in this general area could probably receive a certain degree of guidance from the National Research Council.

6. *Bioassays*—Improvements in specificity, accuracy, or time requirement of bioassays contribute so much that there is constant need for intensive effort in that direction. As each factor is identified, the possibility of developing chemical and physical methods of assay is greatly enhanced.

7. *Nutritive value of foods*—Civilian food supplies are likely to become more and more restricted as the war continues and many of the difficulties are likely to persist into the post-war period. Hence our food resources should be developed with special concern for their protection of health, economy of production and distribution, supplemental relation to other foods available, and adaptation to wartime usage. Such a program cannot be developed effectively without regard to the initial nutritive value of our common foods and the retention of nutritive qualities until consumed. Processing, storage, and final preparation

losses should be assessed with care to avoid too great optimism concerning the nutritive value of a given food supply.

Estimations of nutritive intake according to tables that are based upon "edible portion as purchased," involve gross errors. Losses of 30 to 90 per cent of some of the vitamins and minerals from vegetables and fruits during the interval between purchasing and serving are common. It is grossly misleading, therefore, to neglect consideration of the probable or actual content of nutrients in foods "*as consumed.*" On the whole, large scale food processors have been more cognizant of this problem than merchants, housewives, restaurants, hospitals, and other food dispensing agencies. In other words, the need for exploratory types of research on food composition should be carefully balanced against the need for information about losses.

The program of supplying dehydrated foods for use at distant points in the tropics has encountered a series of major difficulties, many of which are nutritional in nature. The exposures to tropical temperatures are too severe for most conventional products to stand up. Losses in flavor, vitamin content, and attractiveness have been greater than expected. Some of the problems are being solved by better control of moisture content, better packaging practice, high sulfite content when processed, and simply eliminating many conventional types of products.

Among the food products that offer great promise for more extensive use in America, special attention should be given to soybeans, because of their high nutritive value and the low cost of production. The horizon for this food item is very bright, but we should not underestimate the seriousness of the snags between production and acceptance.

AVIATION

No other area of war activity seems to be more critical than aviation with respect to victory. The highly specialized field of aviation medicine had only a brief opportunity for development, in the sense of war needs. Two major stresses are frequently imposed on the body during flying: (a) a decreased supply of oxygen and (b) a lowered atmospheric pressure. Added to these stresses frequently are extremes of temperature, intense light glare, night flying, intense acceleration, deceleration and centrifugal stress, prolonged nervous strain, confinement in position, and irregularity of schedule. Those who are familiar with the complexity of physiological adjustments that are demanded by the above stresses can readily realize that there is need for intensive research on the problems, from a nutritional point of view. Chronic fatigue, gas distention, mild and acute anoxia, alkalosis due to hyperventilation, changes in steroid metabolism, impaired vision, diuresis, and changes in excretion of respiratory catalysts are among the recognized disturbances caused by altitude exposure. Obviously there is a reasonable prospect that nutrition would have a bearing on the body's performance under the influence of such stresses, and there is an obligation upon research laboratories to help find answers to the many questions that are involved, whether they work from wartime or peacetime motives. The latter point is mentioned because it is felt that clear provision should be made for the coöperation of the Selective Service Office in making arrangements for men classified as conscientious objectors, to serve as experimental subjects on government sponsored research projects. The contribution of such studies to protection of civilians and the advancement of aviation medicine is very real.

Influence on temperature—There have

been relatively few studies to indicate the optimum proportions of protein, carbohydrate, and fat for the best maintenance of physical vigor in such areas as the tropics and the arctic. Nearly all of the data available with respect to diet and working efficiency have been obtained under moderate conditions of environmental exposure. There is a good theoretical basis for expecting differences in performance in response to variations of the above type.

A number of papers have given preliminary indications of higher requirements for the water soluble vitamins when men are exposed to high temperatures. The evidence available is extremely fragmentary, however, and not in agreement as reported from different laboratories.

Long before the war it had been generally accepted that exposures to high temperatures made necessary a higher intake of salt to balance excessive losses in perspiration. Observations in mines and mills had led to routine provision of extra salt for workmen. A number of the related problems had not been adequately solved, however, in a manner that would meet the requirements of either the civilian or military personnel operating in tropical areas. Even the quantitative correlation between salt requirement and perspiration had not been established satisfactorily as a basis for maintaining optimal work output, nor was there clear evidence with respect to the best manner of administering the added supplies of salt. Some physicians advocated salt pellets, others advocated salt in the drinking water, and still others preferred to supply salt with the regular food intake. Tests carried out since the war began make it clear that there is a difference in the performance of men, depending upon the method of administering salt.

Thirst—Desert operations and provision for stranded groups, such as may occur on life rafts, often make it necessary to utilize with utmost efficiency limited and inadequate supplies of water and food. One will not find in the literature adequate evidence to indicate the most efficient manner of utilizing limited supplies for maintaining survival.

Partial inanition—Neither is there adequate information with respect to the optimal composition of foods that should constitute emergency rations where there is a prospect of prolonged caloric insufficiency. The proportions of carbohydrate, fat, and protein, and the content of minerals and vitamins would almost certainly have a bearing upon survival through prolonged periods of diminishing food supplies.

Shock—The possible influence of special dietary regimes to afford optimal conditions for recovery from shock, or resistance to the stresses that induce shock, such as trauma, severe hemorrhage, explosions, and exhaustion, has not been explored to the degree that the importance of the subject seems to justify.

THE PUBLIC HEALTH ASPECTS OF NUTRITION

Among research workers who have studied most carefully some of the relationships between nutrition and health in experimental animals under rigidly controlled conditions, there is considerable confidence that improved human nutrition, well above the levels that protect against deficiency diseases, would contribute in a very significant way to better public health. Many physicians and students of public health are in agreement with that point of view. Nevertheless it must be granted that the amount of evidence obtained under satisfactorily controlled conditions is relatively inadequate, and that as a result many professional people in such fields as medicine, public health, education, industrial management, and civic

administrations are not fully convinced of the importance of nutrition.

Among the more significant clinical studies in recent years may be cited the study by Burke, Beal, Kirkwood, and Stewart; earlier studies by Ebbs, Scott, Tisdall, Moile, and Bell of Toronto; and the reports by Sir John Orr and his associates in England. If the relationship between diet and health that is indicated by the above three studies holds for a large proportion of our population, then the entire subject of nutrition, both from a research and from an applied point of view, would seem to merit a much larger degree of attention than it has received.

Among the public health areas of study that would seem to afford great promise for nutrition research, the following may be cited:

1. Maternal nutrition in relation to the health of mothers and infants
2. Infant nutrition in relation to both physical and mental development
3. School and community feeding programs that will provide for better nutrition during childhood and adolescence
4. Adult nutrition as a means of maintaining a more satisfactory level of health, particularly with respect to protection against metabolic and neurological disturbances that commonly accompany approaching old age. The latter field of research has scarcely been touched, even though there has been a considerable expression of interest in the "science of geriatrics," and a few groups have been organized to give the subject more intensive consideration.

There is general agreement that the current incidence of dental caries in America and in nearly all other sections of the civilized world constitutes a health impairment of very great importance. There are many different theories with respect to the major factors involved, but there is little clear-cut evidence that is generally acceptable to critical students of the problem. With a record of approximately one man in five rejected because of dental defects, of those rejected on physical examination for the United States Army during the early period of the war, concrete evidence was provided concerning the importance of the problem. Many other studies have been reported in the literature to supplement the observations with respect to men called for military service.

Three great difficulties have stood in the way of progress in studying human nutrition: (1) the lack of adequate controls during the course of observation; (2) the shortness of time during which careful observations have been made (e.g., in contrast, Professor Sherman's rat experiments now correspond roughly with human time reaching back to the reign of the Caesars); and (3) the relatively high cost of conducting well controlled experiments. With adequate interest and planning, however, it should be possible to overcome enough of the handicaps to secure the information that is most critically needed.

C. G. KING, PH.D., *Chairman*
WALTER H. EDDY, PH.D.
MARJORIE M. HESELTINE
HELEN A. HUNSCHER, PH.D.
HELEN S. MITCHELL, PH.D.
ROE E. REMINGTON, PH.D.
LYDIA J. ROBERTS, PH.D.
WILLIAM H. SEBRELL, JR., M.D.
JANE SEDGWICK

Food Conservation*

Food and Nutrition Section

THIS country has never faced a more critical period in respect to its food supplies than the months and years immediately before us. Despite an abundance of many United States food crops during the past two harvest seasons, with the highest levels ever reached, our obligations to feed our armed forces, our civilian population, and materially aid our Allies and the population of such other areas as may be necessary, will cause an unprecedented demand on every type of available food supply.

A part of this demand may be met by additional emphasis on food production. With the limitations of man power, agricultural equipment and supplies which exist due to the war effort, this approach to the problem, worthy as it is, cannot be expected to provide a complete solution.

We must also embark on a planned program of food conservation, world-wide in scope, geared to recent and accurate scientific information concerning food utilization in the most efficient and least wasteful methods. Such a program must start on the farm where crops are planned and planted for specific purposes, and end not at the table as in the past but at the chemical plant where wastes of the table are reconverted to foods, feed, or fertilizer for further use in growing more foods.

Such a program will be intimately concerned with the health and morale of our population, the economic status of our citizens, and the success and timeliness of our war effort, because foods are no longer only foods. Foods are also to a considerable extent the raw materials of our munitions industries, our textile industries, our plastics industries, and others. Our pharmaceutical industries depend on foods for the raw material source used as the basis for the production of the new and vitally important drug, penicillin, which has shown such remarkable life-saving properties.

Recent developments in the field of nutrition indicate that much could be done to improve the diet of a large percentage of our population without making changes which are either restrictive or unpleasant. With the strides which have recently taken place in respect to vitamins and proteins, we are much better equipped to supplement the gaps in nutritional inadequacies by the use of simple foods and by-products of peanuts, soybeans, and the dairy industry. The residues of cereal germs after removal of their valuable oils have attained recognition as valuable potential foods for man as well as feeds for meat-producing farm animals.

The hydrolysis of protein residues gives promise of additional amino-

* Report of the Committee on Foods (Except Milk).

COMMITTEE ON FOOD (EXCEPT MILK)
Organized 1932. Published reports: *Year Books* 1933–1934, 1934–1935, 1935–1936, 1936–1937, 1937–1938, 1939–1940, 1940–1941.

acid containing foods of high biological value.

Adequate conservation of our food supplies will require the leadership of our most inspiring and able workers in every profession, including medicine and public health. It will require the understanding and coöperation of every man, woman, and child in this country and in others. To accomplish the goal will require the greatest mass effort in health education that has ever been projected. It can pay dividends in the improved welfare of our people and, simultaneously, contribute in a large way to the war effort.

Some of the factors concerned in the effective formulation of such a program are the following:

1. Conversion of agriculture to crops which produce
   a. More food per unit of area
   b. More nutritious foods per unit of area
   c. More food per unit of man power expended in production
2. The consumption of smaller total quantities of food without losing nutritional value by
   a. Better choice of foods in the diet
   b. Elimination of inefficient foodstuffs
   c. Insuring that those who get too much food use less, and those who are on a poor diet get more of the needed commodities
   d. Wider utilization of food by-products of high nutritional value
3. The prevention of food losses, caused by
   a. Improper storage—absence of refrigeration
   b. Poor and possibly unsafe processing methods
   c. Poor packaging methods causing wastage
   d. Improper and excessive cooking which lowers vitamin content
   e. Faulty use of prepared foods, such as discarding cooking water
   f. Preparation of excessive quantities of food for the number of persons to be fed
   g. Ignorance of means by which food residues may be used in other forms
   h. Plate waste—the serving of more food than an individual can utilize at the time
   i. Waste of fats which may be salvaged either in the kitchen or by installing grease traps in larger institutional cooking establishments
   j. The possible extension of garbage disposal facilities in municipalities with fat recovery—or garbage feeding of swine
   k. Failure to consider the enormous food savings involved in meat cutting and trimming in centralized agencies where all excess fat and bones may be rendered for subsequent food uses
   l. Failure to consider the food wastage involved in feeding domestic pets which are consuming food that could feed thousands of humans

No doubt there are other considerations involved which are equally important. If each of these mentioned were thoroughly studied, however, and if every member of this Section and this Association were to expend his own utmost endeavors to correct such defects and help to activate a moving program along such lines, it would result in a great boon toward victory, toward better health for more people, and to a better world in the future.

A start in this direction could be made by the collection and publication of data on food losses by the members of the Food and Nutrition and the Laboratory Sections. The Health Education Section could coöperate in the preparation of proper media for the presentation of such information to the public. The Governing Council could collaborate with and aid those government agencies which are concerned in various phases of this type of food conservation.

It is the recommendation of this committee that a resolution be presented to the Governing Council of the Association indicating the desirability of a national food conservation campaign and the willingness of this Association to sponsor and contribute in every possible manner to the fulfillment of any program or duties

relating to the same which would facilitate the conservation of food in the war effort.

BERNARD E. PROCTOR, PH.D., *Chairman*
EDWIN J. CAMERON, PH.D.
GERALD A. FITZGERALD
FRANK L. GUNDERSON, PH.D.
CHARLES D. HOWARD
A. C. HUNTER, PH.D.
MILTON L. LAING
ETHEL AUSTIN MARTIN
JEROME B. TRICHTER

West Indian Conference of the Anglo-American Caribbean Commission

The West Indian Conference of the Anglo-American Caribbean Commission was held in Barbados, British West Indies, during the period March 21 to 30, 1944. The meeting was attended by a large group of delegates and technical advisers from British and United States territories in the West Indies, in addition to members and advisers of the British and United States Sections of the Commission. Observers were sent by the Netherlands and the Canadian Governments.

Of the six general topics considered, three related to medicine and public health. These were: (1) Health protection and quarantine, (2) the planning of public works and thereby the provision of better facilities for environmental sanitation and medical care, and (3) the establishment of a section on public health and medicine of the Caribbean Research Council.

II. Vitamin B Complex

Status of Assay Methods and Need of These Substances by Man*

Food and Nutrition Section

THE three most widely used members of the vitamin B complex were discussed in detail in the last prepared Committee Report given at the Detroit meetings in October, 1940.[1] Since that time clinical and laboratory findings have further elucidated the deficiency diseases resulting from lack of thiamin (B_1), riboflavin (B_2), and nicotinic acid (niacin). In fact, the diseases resulting from a lack of one or more of the above were known before the individual vitamins were isolated and synthesized. However, once this was accomplished, great progress was made in the matter of assays either by microbiological or physico-chemical methods. This meant a great saving in time as the application of such technic obviated the necessity of long-time animal assay methods. Since more refined assay methods are available and quicker results may be obtained more work accrues.

Since the last committee report on this subject was rendered,[1] considerable progress has been made in assay methods, and the need for the various components in the diet of man revealed. Newer members have been added to the B complex so that a summary of each individual component with status of assay methods and needs for the diet of man seems to be in order.

THIAMIN (B_1)

Thiamin hydrochloride is a white, crystalline substance, readily soluble in water, possessing a nut-like, salty taste, and yeast-like odor. The empirical formula is $C_{12}H_{18}N_4OSCl_2$.

In foods and tissues it occurs in the free form and as thiamin pyrophosphate or cocarboxylose. In the latter form it functions in the living cell as a coenzyme in carbohydrate metabolism. In thiamin deficiency the metabolism of sugar is incomplete and pyruvic acid accumulates in the tissues. This gives rise to toxic symptoms, a condition which is used clinically in determining thiamin insufficiency. Many of the symptoms which have been observed in beriberi may be related to faulty carbohydrate metabolism, although it is still difficult to differentiate an uncomplicated thiamin deficiency from multiple deficiencies.

The variety of symptoms seen in man has been summarized by Spies and Williams [2] and by Jolliffe.[3] Wilder [4] has pointed out that the type of symptoms which develop depends to a considerable extent on the rate at which the deficiency develops, but he states that in all cases the subjects become depressed, irritable, quarrelsome, uncooperative, and fearful. An anemia of the hyperchromic type has also been

* Report of the Committee on Assay of Foods

COMMITTEE ON ASSAY OF FOODS
Organized 1934. Published reports: *Year Books* 1935–1936, 1938–1939, 1940–1941.

described in a number of thiamin deficient patients.

The official method for the estimation of thiamin is the rat assay procedure described in the U.S.P. XII. Since our last report, both the thiochrome [5] and yeast fermentation [6] methods have been widely used and commented upon. Recently the thiochrome method [7] has been adopted by the U.S.P. and sanctioned for thiamin determination in addition to the rat assay technic. The thiochrome and yeast methods have the advantage that they are quicker and can be used for substances of low thiamin content.

Because of the fact that significant amounts of thiamin may be lost during the preparation of foods, due to the ready solubility of the vitamin in water and lability to heat, it is suggested that food tables be consulted and the minimal value in these tables be used in computing the amounts of this dietary factor.

RIBOFLAVIN (B_2)

Riboflavin is an orange-yellow, crystalline compound, showing a characteristic yellow-green fluorescence in aqueous solution. The vitamin is rather heat stable, especially in acid media, but extremely labile when exposed to light. The empirical formula is $C_{17}H_{20}N_4O_6$. In nature riboflavin may exist as such or as riboflavin phosphate, or as a constituent of specific flavoproteins, the latter functioning as important enzymes in tissue respiration. With a deficiency of riboflavin a definite reduction in tissue concentration of the enzyme has been shown.[8]

The symptoms of riboflavin deficiency syndrome [9] in man may be divided into three groups: A. Ocular Symptoms, B. Oral Symptoms, C. Skin Lesions.

In regard to the ocular symptoms, photophobia and interference with vision follow. With the earliest changes seen in the eye is a growth of capillaries into the cornea. These fine capillaries cross the sclerotic and go into the cervix of the cornea. They can be seen only by the slit lamp microscope. A corneal microscope is required in order to see those vessels steadily enlarge and proliferate into the cornea until a lesion develops which can be seen grossly, and superficially may appear to be a conjunctivitis. As a lesion progresses cloudiness of the cornea develops and in some instances opaque spots or even corneal ulcers may occur. Following the use of riboflavin, these lesions in most instances have completely disappeared, and there is recovery to nearly normal vision. If the lesion is of several years' standing, more time will be required; however, remarkable improvement has taken place in a few days to a week or two.

The oral lesions are largely confined to both lips, in which there is a shiny denuded appearance, and the lips appear to be chapped in many instances. In the corner of the mouth appears a white spot which breaks down. Following this, a transverse fissure in each angle of the mouth appears. It may extend onto the face, covered with a dry, yellowish secretion. If this is removed, a raw, ulcerated crack will be found underneath. The line of closure of the lips becomes quite red and very shiny and glistening. The tongue is discolored, being described as magenta in color, or pulpish red, differing from the red tongue of niacin deficiency. Lesions of riboflavin deficiency appear in the eyes and in ulcerated lesions just inside the nares, frequently on the ears, in the folds of the body, in the groin or under the arms.

The riboflavin content of foods may be determined by measuring the growth response obtained in chicks or rats maintained on basal rations low in the vitamin, but the more rapid microbiological method of Snell and Strong [10]

is now finding wide application, and has been accepted by the U.S.P. as official.[11] Chemical methods involving measurements of fluorescence are also being used.[12, 12a]

Riboflavin is widely distributed in plant and animal material. Liver, milk, and vegetables may be considered the best and most reliable sources in the human dietary. One serving of liver or one quart of milk adequately meets the human daily requirement.

NICOTINIC ACID (NIACIN)

Nicotinic acid occurs as white, needle-like crystals, is non-hygroscopic and stable in air, possessing a bitter taste, and has the empirical formula $C_6H_5O_2N$. The sensation of flushing and erythema of the skin often observed on administration of nicotinic acid is not produced by nicotinic acid amide. Nicotinic acid is a comparatively weak acid and its alkaline salts in solution show a slightly alkaline reaction. It is stable to autoclaving temperature when in solution and shows no loss of activity when exposed to dry heat.

Because of numerous objections to the term nicotinic acid, niacin and niacin amide have been proposed and widely accepted.

In the body niacin functions as a component of two important coenzymes, coenzyme I or cozymase, and coenzyme II, which are concerned in both glycolysis and respiration.[13] In niacin deficiency it is possible to demonstrate a decreased cozymase content of liver and muscle tissue. The early symptoms of pellagra are dermatitis, weakness, lassitude, anorexia, mental depression, and indigestion, followed by sore and ulcerated mouth and diarrhea. However, Goldberger's classical description of pellagra (*Tice Practice of Medicine*) should not be overlooked. More detailed summary of symptoms has been recently made by Harris,[14] and by Youmans.[15] Spies, Walker, and Woods[16] have shown that infants and children also suffer from nicotinic acid deficiency in areas where pellagra is endemic, although typical lesions are seldom seen in infancy. Nicotinic acid is now widely used in the treatment of pellagra but its use is most successful in conjunction with other vitamins and specific natural foods.

Since nicotinic acid is not required preformed in the diet of the rat, the dog, originally used by Goldberger and his coworkers for the assay of the anti-pellagra potency of foods, is the only animal that can be used with any success. Fairly accurate values can be obtained by comparing the growth response obtained by feeding a definite weight of food with that obtained after giving a standard dose of nicotinic acid.[17] Chemical methods may be used on many foods and an improved method has recently been described by Dann and Handler.[18]

A convenient and apparently satisfactory microbiological method has been described by Snell and Wright.[19] In general there is a good agreement between results obtained with the three methods except in case of liver and kidney. The values obtained with the dog assay for these materials are somewhat higher than the values obtained by chemical or microbiological methods. The best sources of nicotinic acid include liver, yeast, and lean meats.

The existence of the remaining members of the B complex is based largely upon work with animals and the use of these factors in practical nutrition is not too clearly understood. This does not mean that these newer factors are not essential in the metabolism within the body, but the corresponding deficiency diseases are not so apparent. This situation may be due to several factors: first, the recognition of the additional B vitamins is so recent that extensive clinical studies have not been

made; second, these factors are so widely distributed in a variety of foods that a serious deficiency is less likely to occur; and third, some of them at least are produced in the intestinal tract by bacteria.

PYRIDOXINE (B_6)

Two additional compounds, namely, pyridoxine and pantothenic acid, were added to the B complex between 1938 and 1940. Pyridoxine was recognized through its ability to prevent a dermatitis in rats which was observed during attempts to produce experimental pellagra in rats. It was first obtained in crystalline form in 1938, and its synthesis was described by Harris and Folkers [20] shortly thereafter. Pyridoxine hydrochloride is a white crystalline powder, slightly bitter in taste and odorless, possessing the following empirical formula: $C_8H_{12}O_3NCl$.

Pyridoxine deficiency in the rat has always been associated with a specific dermatitis called acrodynia by György,[21] although it has been demonstrated [22] that a lack of this vitamin may cause retarded growth without the dermatitis if ample fat is supplied in the diet. It appears [23] that linoleic acid, pyridoxine and pantothenic acid are together concerned in the prevention of dermatitis. Chick and coworkers [24] reported convulsions in pyridoxine deficient rats and pigs resembling epileptic fits in man. Convulsions in dogs were observed by Fouts, et al.,[25] and Wintrobe [26] has recently described convulsions in pigs on pyridoxine low diets.

A microcytic hypochromic anemia also results from a chronic pyridoxine deficiency in dogs [27] and pigs.[26] The hemoglobin and the red cells decrease progressively, the hemoglobin relatively faster than the red cells. Addition of pyridoxine causes a larger reticulocyte response, with rapid increase in hemoglobin and red cells until the normal level is attained. Rats,[28] pigs,[29] and to some extent dogs [30] excrete in the urine a green pigment when on diets low in pyridoxine. Lepkovsky, et al.[31] have now identified this compound as xanthurenic acid and have shown the compound to originate from dietary tryptophane. These and other results indicate that pyridoxine may be closely related to protein metabolism.

No clear-cut symptoms resulting from pyridoxine deficiency have been described in man. Spies, Bean, and Ashe [32] have reported an additional improvement in pellagrins by giving pyridoxine after treatment with nicotinic acid, riboflavin, and thiamin. Smith and Martin [33] observed a rapid and satisfactory healing of the typical lesions of cheilosis with vitamin B_6 therapy. Although clinical treatment of such conditions as Parkinson's disease, muscular dystrophy, and paralysis agitans has been studied, the results are not definite enough to associate any one of these syndromes with specific lack of pyridoxine in the diet. Pyridoxine administration has been reported to have been used with some success in reduction in the oiliness of the skin in cases of acne.[34]

The human requirement is unknown but animal experiments indicate that it may be about the same as thiamin, namely, 1 to 2 mg. per day. In fact, the vitamin B_6 requirement of chicks is higher than that for thiamin, 300γ B_6 per 100 gm. ration. There appears to be no difficulty in meeting this requirement because of the wide distribution in foods. Swaminathan [35] found diets consumed in India to supply 3.5 to 5.0 mg. per day. Chemical methods have been used for the estimation of vitamin B_6 but the rat growth method is still the most reliable. The yeast method [36] has been found to give results comparable to those obtained with rats. Among the best sources of vitamin B_6 are rice bran, liver, yeast, cereals, legumes, and milk.

PANTOTHENIC ACID

Pantothenic acid in the form of calcium pantothenate became available in 1940. The term "filtrate factor" was used for several years to designate that fraction of the B complex which prevented dermatitis in chicks. Although the so-called filtrate fractions from liver extract were effective in the prevention of black tongue in dogs, pellagra in man and dermatitis in chicks, it was recognized as soon as nicotinic acid was accepted as the antipellagra factor that the activity of these fractions for the chick was not due to the nicotinic acid present but to a separate and distinct vitamin. Woolley, Waisman, and Elvehjem [37] and Jukes [38] independently demonstrated that pantothenic acid, which Williams [39] had shown to be a growth factor for yeast as early as 1933, was similar to the chick antidermatitis factor. The complete synthesis of calcium pantothenate which has the empirical formula $(C_9H_{16}NO_5)_2Ca$ was achieved by Stiller, et al.[40]

Rats placed on diets low in pantothenic acid grow very poorly and in a few weeks develop necrosis of the adrenal cortex, a condition first described by Daft and Sebrell.[41] When black or piebald rats are used, significant changes in hair pigmentation (graying) can be observed. Unna, et al.[42] have published photographs of these fur changes in nutritional achromotrichia. Ralli and Graef [43] have shown that adrenalectomy will cause an increase in the deposition of melanin in the hair bulbs and follicles of rats showing graying due to filtrate factor deficiency.

Acute pantothenic acid deficiencies in dogs [44] are characterized by sudden collapse, associated with decreased blood dextrose, increased non-protein nitrogen, and lowered blood chlorides. Severe intussusception in the intestinal tract and fatty livers have also been observed. Scudi and Hamlin [45] found a lowering of blood lipids to accompany the occurrence of fatty livers. Hughes [46] and Wintrobe [47] have described the following symptoms as occurring in pigs on a pantothenic acid deficient ration: slow growth, rough coat, loss of hair, ulcers in the intestinal tract, and a "goose stepping gait" as a result of pantothenic acid deficiency in pigs. Phillips and Engel [48] found specific neuropathologic changes in the spinal cord of chicks suffering from pantothenic acid deficiency and Wintrobe [47] has described sensory neuron degeneration.

In spite of these interesting symptoms in experimental animals, little is known about the importance of this vitamin in human nutrition. Spies and his coworkers [49] concluded from studies based largely on blood pantothenic acid values that it may be essential in human nutrition. Gordon [50] found the average daily excretion for 40 subjects to be 3.5 mg. The daily human requirement may fall within 5 to 10 mg. per day.

The pantothenic acid content of foods may be measured by growth experiments with chicks, but the microbiological methods [51] are now in more general use. Liver is one of the richest sources, containing about 5 mg. per 100 gm. of fresh liver. Meats, cereals, and milk are also reliable sources. Brandaleone, et al.[52] have recently reported that in a group of 19 elderly individuals with gray hair a significant color change was noted in only 2 individuals during intensive therapy with calcium pantothenate, para-aminobenzoic acid and brewers' yeast.

CHOLINE

Although there may be some question about the propriety of the inclusion of choline in the discussion of the vitamin B complex, the fact that choline is now added to most of the purified diets used in vitamin studies suggests that

it is logical to discuss its nutritional significance along with this group of compounds. Choline has been recognized for many years as a component part of phospholipid lecithin, but its possible need in the diet was not apparent until Best demonstrated its rôle in the prevention of fatty livers in depancreatized dogs.[53] The one function of choline is related to the mobilization of fatty acids in the body, since in its absence liver fat accumulates rapidly. Fatty livers in rats induced by feeding high cholesterol diets do not respond to choline treatment. The observations of duVigneaud and his collaborators[54] that the methyl groups of choline as well as those of methionine and betaine are transferable in the animal organism has led to the conclusion that another function of choline is to supply labile methyl groups. McHenry[53] states that there is evidence now that choline may function in at least three ways: to stimulate the formation of phospholipids, to make possible the production of acetyl choline, or to supply labile methyl groups.

Jukes[55] has shown that choline is one of the factors required in addition to adequate manganese to prevent slipped tendons or perosis in young turkeys. Depression of the growth rate when choline is omitted from the diet has been observed in the case of the rat by Richardson, et al.,[56] in the chick by Hegsted, et al.,[57] and in the dog by Schaefer, et al.[58]

The high requirement of the young rat for choline has been stressed by Griffith[59] who previously reported fatty degeneration of the liver, hemorrhagic renal lesions, ocular hemorrhages, and regression of the thymus within ten days after the rats had been placed on a low choline but otherwise adequate diet. Cirrhosis of the liver in rats fed diets low in choline and protein has been reported by György and Goldblatt,[60] Blumberg and McCollum,[61] Webster,[62] and Lowry, et al.[63] The results of these studies have been summarized in *Nutrition Reviews*, Vol. 1, p. 88 (Jan.), 1943.

Fouts[64] has described fatty cirrhotic livers in dogs receiving the B vitamins in synthetic form without choline. Partial clinical improvement followed the administration of large amounts of choline, but combined administration of choline and liver extract produced more rapid improvement, although fibrosis of the liver still persisted. Some success has been reported with choline in the treatment of portal cirrhosis in man (Brown and Muether[65] and Fleming and Snell[67]), but the workers suggest that improvement is possible only when hepatic damage is not too far advanced. With the present necessary modifications in the protein and fat sources in the human diet it is well to consider the foods which can be depended upon to supply choline. Meats, cereals, vegetables, and eggs are good sources of choline. The choline content of a number of animal and plant products has recently been tabulated by Engel.[67]

Reactions which have been used for the determination of choline include its oxidation to trimethylamine,[68] the formation of an insoluble complex with iodine,[69, 70] the isolation of the choloroplatinate or chloroaurate,[71, 72] and the precipitation of choline as the reineckate.[73] In the latter method choline reineckate is separated from other reineckates by virtue of its insolubility in water and ethyl alcohol. When dissolved in acetone, it forms a red solution which can be measured colorimetrically. A method based on this reaction was studied in detail, either the Bausch and Lomb spectrophotometer or the Evelyn photoelectric colorimeter being used to measure color intensity. Application of the latter method to rat tissue was reported by Jacobi, et al.[74]

BIOTIN

Biotin has been recognized as necessary for the growth of microörganisms for some time, and its significance in the nutrition of animals has been elucidated within the past year or so. Biotin was first isolated in 1936 by Kögl and Tonnis [75] but its complex nature and its minute concentration in natural products delayed identification of its structure. duVigneaud and coworkers [76] have recently shown that biotin has the following empirical formula: $C_{10}H_{16}O_3N_2S$. Biotin is a stable compound, resisting autoclaving with strong mineral acids, and in the form found in natural products is but slowly inactivated with strong alkali. It is readily destroyed by oxidizing agents.

It has been known for many years that a characteristic syndrome can be produced in rats fed diets containing high amounts of raw egg white. Lease, Parsons, and Kelly [77] found that the rabbit and the monkey also exhibited a typical dermatitis when fed rations containing egg whites. As early as 1933[78] Parsons concluded that the injury involved an interrelation between a positive toxicity and a relative absence of a protective factor, and a little later György named this factor vitamin H. Birch and György [79] obtained highly potent concentrates of the factor, and in 1940 duVigneaud, Melville, György, and Rose [80] suggested the identity of biotin and vitamin H.

György, Rose, Eakin, Snell, and Williams [81] have now established the presence of "avidin" (an albumin) as the biotin inactivating factor in egg white. Thus it becomes apparent that egg white injury is due to the unavailability of biotin by virtue of being tied up with avidin, in which complex biotin cannot be absorbed from the intestine and is excreted in the feces. Nielsen and Elvehjem [82] using a more complete ration than had been used in the early work, were able to demonstrate a biotin deficiency in the rat fed 10 per cent levels of egg white. Typical symptoms of "spectacled eye," progressing to general alopecia and in the later stages the onset of a spasticity and final death of the animal, were recorded. Even the severe symptoms of spasticity were cured when excess biotin (in excess of that which unites with the avidin) was added to the diet. On the synthetic diet without the egg white these workers were unable to demonstrate any signs of biotin deficiency and it seems probable that under most conditions the rat can synthesize, through the medium of bacteria in the intestine, sufficient biotin for its requirement. Biotin deficiency has been reported in the chick without resorting to egg white diets, which seems to indicate that very limited synthesis of biotin in the intestinal tract must prevail. A typical dermatitis involving the feet was found by Hegsted, et al.[83] to be characteristic of the deficiency in the chick, and Patrick, et al.[84] also have noted similar dermatitis with turkeys on biotin deficient rations.

Rather definite information is available regarding the importance of biotin in human nutrition. Sydenstricker and coworkers [85] produced a deficiency in man by feeding egg white at a level which supplied 30 per cent of the calories. Symptoms of dermatitis developed as early as the 3rd and 4th weeks, and other symptoms similar to those seen in thiamin deficiency were observed. All symptoms were cured by the parenteral administration of 150–300γ of biotin per day. Oppel [86] has shown that the biotin content of the urine is influenced by the amount in the diet. Most of the normal subjects excreted 20–50γ per 24 hours and he was unable to find a single patient that did not excrete biotin. Sydenstricker's patients receiving egg white showed levels at low as 3.5γ per day. Oppel

also reported that diets of average composition contained 30 to 40γ per day or 10 to 16γ per 100 gm. dry food. The latter value is interesting because the biotin requirement of chicks is 7 to 10γ per 100 gm. of ration.[83] When the biotin content of the feces was also determined the total biotin output was 3–6 times as great as the intake from the diet. Thus there is apparently intestinal synthesis of biotin in man as well as in the rat. The intake of biotin in the diet may not be important except in special cases. It should be kept in mind, however, that a lack of some of the other B vitamins may cause deficiencies due to reduced synthesis of biotin, as well as a deficiency due to a direct lack of the vitamin in the body tissues.

Biotin can be conveniently determined by use of microbiologic methods of assay in which responses in yeast growth (Snell, Eakin, and Williams[87]) or acid production by *Lactobacillus casei* (Shull, Hutchings, and Peterson[88]) are measured. Biotin is almost ubiquitous in distribution, but liver, kidney, yeast, and egg yolk are the chief sources. It is to be emphasized that in most tissues biotin is present in a "bound" state in which it cannot be extracted by hot water, and autolysis or acid hydrolysis must be employed to realize the true concentration of biotin in these instances.

INOSITOL

The significance of inositol in animal nutrition was first recognized through the use of the mouse. Eastcott showed as early as 1928 that inositol would stimulate the growth of yeast. In 1940 Norris and Hauschildt[89] found that mice failed to grow on a synthetic diet containing the known members of the B complex. In addition to lack of growth, the animals showed loss of hair and scaly dandruff. Liver and yeast supplements produced normal animals. Woolley[90] described a similar condition and identified the factor in the yeast and liver as inositol. Further studies[91] indicated that some of the animals without inositol showed spontaneous cures. Cultures from the intestinal tract of the mice showing the spontaneous recovery yielded organisms which would synthesize much more inositol than cultures taken from the tract of mice that remained hairless. This synthesis was not observed when pantothenic acid was absent from the diet. Since no one has been able to demonstrate the need for inositol in the diet of growing rats, there is apparently sufficient synthesis by the bacteria to meet the requirement. Whether this is true in man remains to be determined.

Inositol can be determined in tissues and foods by using a microbiologic assay employing a specific strain of yeast as the test organism.[92] By this method of determination, Williams and his coworkers[93] have made large numbers of assays on various rat and beef tissues and found spleen, heart, kidney, brain, thyroid, and testes to be especially high in inositol. As previously mentioned, inositol in the form of phytin is present in large amounts distributed throughout the plant kingdom; cereal brans and seeds are exceptionally good sources. No work has been done on the possible significance of inositol in human nutrition.

PARA-AMINOBENZOIC ACID

Para-Aminobenzoic acid was first described as a bacterial growth factor by Rubbo and Gillespie[94] and Ansbacher[95] concluded it was a vitamin in 1941. Sieve[96] has used it as an achromotrichia factor. The fact that this compound is widely distributed in nature suggests that it may be an important vitamin. In the chick it can partially compensate for the lack of liver extract factors when fed at high levels. Thus it may have an indirect

effect by altering the synthesis of other factors in the tract. Martin [97] has reported similar results in the rat and suggests that it may have such an effect in man.

OTHER FACTORS

In order to study still other possible members of the B complex it has been necessary to use rats receiving sulfaguanidine or succinyl sulfathiazole, or chicks and monkeys on synthetic diets containing the nine B vitamins mentioned so far.

If 0.5 per cent sulfaguanidine or succinyl sulfathiazole is added to a synthetic diet containing thiamin, riboflavin, nicotinic acid, pyridoxine, pantothenic acid, and choline and fed to rats, the rate of growth is greatly reduced and the prothrombin time of the blood is increased. The addition of liver extract to this ration gives optimum growth and normal clotting time of the blood.[98] The liver extract can be replaced by a folic acid concentrate and biotin.[99] Thus the rat requires biotin and one or more factors in the folic acid concentrate, but under normal conditions these factors are produced by the intestinal bacteria. Gant, et al.[100] have shown a reduction in the coliform organisms in the tract of rats upon feeding succinyl sulfathiazole. Spicer, Daft, Sebrell, and Ashburn [101] have reported a consistent development of a leucopenia and an agranulocytosis in rats receiving sulfaguanidine or succinyl sulfathiazole in synthetic rations. The total number of leucocytes dropped from a normal of 10,000 to less than 1,000 in severe cases.

Chicks fed a modified synthetic diet plus the synthetic B vitamins, including biotin and inositol, not only fail to grow but show very poor feathering and a rather extensive anemia.[102] All three deficiencies can be counteracted by adding 2 per cent liver extract or 5 per cent yeast to the diet and all the activity can be concentrated in crude folic acid preparations from these foods. Similarly monkeys fail on synthetic diets but live and develop normally if liver extract, grass juice powder, or a crude folic acid preparation is used.[103]

VITAMIN M

When given a diet deficient in the B vitamins, rhesus monkeys develop a syndrome characterized by anemia, leucopenia, oral lesions, diarrhea, and susceptibility to bacillary dysentery.[104–114] The syndrome cannot be prevented or cured by any combination of the now commercially available pure vitamins, but can be prevented, and sometimes cured, by yeast, fresh liver, and certain crude liver extracts. The term "vitamin M" was proposed for the nutritional factor.[106] There is evidence that xanthopterin may partially or completely protect the monkey against this nutritional cytopenia when fed in combination with the other available B vitamins.[115] It has also been reported that "folic acid" concentrates are active in correcting the anemia and leucopenia in this experimental condition in the monkey.[112, 113] Since "folic acid" concentrates appear to contain xanthopterin [116] it is not clear whether this activity is due to the "folic acid" as such, or to the xanthopterin, or to a combination of the two. There is some evidence of a biological nature for a relationship between "folic acid" and xanthopterin.[117] Until the exact relationship between "folic acid," xanthopterin and "vitamin M" is clarified it will not be possible to use the microbiological method for "folic acid" [118] as a measure of "vitamin M."

At the present time the only specific assay method for "vitamin M" is the bio-assay based upon the protection of the monkey against nutritional cytopenia, or the cure of nu-

tritional cytopenia. The protective method is laborious as it is necessary to protect a monkey for approximately a year in order to demonstrate the effectiveness of a supplement. The curative technic is not always satisfactory, as the monkeys enter an irreversible phase if the deficiency is allowed to progress too far.

It is evident therefore that the remaining members of the B complex can be concentrated in a crude folic acid concentrate. Most of these preparations have been made according to the procedure described by Hutchings, Bohonos, and Peterson.[119] These workers used the *Lactobacillus casei* for the assay of the activity. Mitchell, Snell, and Williams[120] used spinach as the source of their factor and the *Streptococcus lactis* as the test organism. They named the factor folic acid and found a rather pure concentrate to stimulate the growth of *L. casei* as well as *S. lactis*. For some time the two factors were considered to be the same, but very recently Keresztesy, Rickes, and Stokes[121] isolated a pure substance which is effective for *S. lactis* but is inactive for *L. casei* and they suggest that it is not folic acid. Pfiffner, et al.[122] have obtained from liver a compound in pure form which is active in preventing anemia[123] in chicks on purified diets. These workers have retained the term B_c for this compound and they suggest that it may be identical with both the *L. casei* and *S. lactis* factors. In light of the above report this is not possible. The question which remains therefore is: are the two bacterial growth factors related to the factors needed by the rat, chick and monkey? Briggs, et al.[124] have clearly demonstrated that the chick requires two factors which are separate and distinct from the *S. lactis* factor. These two factors have been temporarily called vitamins B_{10} and B_{11}. It is more likely that the factor needed by rats fed the sulfonamides and by monkeys fed synthetic diets is related to the *L. casei* factor, especially since the factor corrects an anemia in chicks. The final isolation of these factors will do much to give us a complete picture of the remaining B vitamins.

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HENRY T. SCOTT, PH.D., *Chairman*
MORRIS ANT, M.D.
FULLER D. BAIRD
HOWARD J. CANNON
PAUL L. DAY, PH.D.
CONRAD A. ELVEHJEM, PH.D.
ELMER M. NELSON, PH.D.
ROBERT W. PILCHER, PH.D.

BOOKS AND REPORTS

All reviews are prepared on invitation. Unsolicited reviews cannot be accepted.

Medicine and the War—*Edited by William H. Taliaferro. Chicago: University of Chicago Press,* 1943. 193 pp. Price, $2.00.

This admirable series of ten popular lectures was delivered in the spring of 1943 by members of the faculty of the Division of the Biological Sciences of the University of Chicago under the sponsorship of the Charles R. Walgreen Foundation for the Study of American Institutions. The historical introduction to war medicine is by Dr. Arno B. Luckhardt, Professor of Physiology. The subjects of Food, Chemotherapy, Malaria, Insects, Shock and Blood Substitutes, Aviation Medicine, Brain Injuries, Psychiatric Disorders, and Chemical Warfare are covered by Professors Paul R. Cannon, E. M. K. Geiling, William H. Taliaferro, Clay G. Huff, Alexander Brunschweig, Henry T. Rickets, A. Earl Walker, David Slight and Franklin C. McLean. The essays are intended to promote a wider dissemination among the general public and the medical profession of basic information concerning recent advances in war medicine. They cover the subjects briefly, although authoritatively, and can be recommended to public health workers who are not experts in these fields of medicine.

GEORGE BAEHR

The Organization of Permanent Nation-wide Anti-Aedes aegypti Measures in Brazil—*By F. L. Soper, D. B. Wilson, S. Lima, and W. Sá Antunes. New York: Rockefeller Foundation,* 1943. 137 pp.

This monograph is a highly detailed account of the organization instituted by the Brazilian Government and the Rockefeller Foundation for the control of the *Aedes aegypti* mosquito in Brazil, stressing the particular problems encountered both in rural and urban areas, and those peculiar to this species of mosquito. It would seem very desirable that the southern states here and the other South American republics should follow this leadership and adopt similar measures.

The most significant fact revealed is the remarkable results obtained by the authors. For example, the incidence of houses with aedes in Natal was reduced from 10 per cent in 1931 to zero in 1934. This, of course, will result in lowered yellow fever and dengue fever rates.

The organization of the text could have been planned better. In the body of the work too many forms for inspectors, diagrams of flags, etc., are included. These could have been placed to more advantage in an appendix along with the intricate details of filling them out. The duties and responsibilities of the personnel are fully explained, but the sequence of this material is broken by the forms.

Only one fault of omission can be readily found, namely, that there is nowhere any reference made as to the training of the inspectors who are the backbone of the organization.

The problems of mosquito control and eradication are most vital at the present time, therefore this book should prove of great value to public health officials who are responsible for this type of work.

WILSON G. SMILLIE

Fundamentals of Personal Hygiene—*By Walter W. Krueger. (4th ed.) Philadelphia: Saunders,* 1944. 315 pp., ill. Price, $1.75.

The preface to the fourth edition of

this book states that the aim of the book is to "motivate the student to formulate a rational health program and thus to acquire the art of living healthfully." How far health teaching and reading books can help in such motivation, the reviewer does not know.

This book was definitely not written with the viewpoint of the youngster in mind. It neglects the natural self-interest of growing up and getting something out of life. It "tells" more than it teaches. The factual material presented is quite detailed regarding physical fitness. Very little can be learned about vision and hearing. The same is true regarding items on community health.

The chapters on the mouth, the skin, the feet, and especially health fads, fancies, and follies are adequately covered. There are two excellent chapters on "Health of the Mind," and one on "Hygienic Aspects of Sex," but what a title.

There are at least two serious mistakes, both in the chapter on "Sunlight and Health." Ultra-violet rays are described as a factor in preventing tooth decay and, an even more dangerous statement, "It is now believed by some investigators that sunlight may prevent death from cancer." Since when do investigators merely "believe"? They should *know*. Theories on prevention and cure should be omitted.

It is beyond our understanding why in the list of "Topics for Oral or Written Discussion" included in the chapter on "Health of the Mind," was the question, "Would a fifth freedom; namely, the freedom of individual enterprise, be of value for mental health *as well as for other reasons?*" (Italics ours.)

Illustrations are supposed to help the reader to understand the text. Unfortunately, most of the illustrations are meaningless, inadequate, and poorly labeled. There are very few original drawings or photographs. Most of the pictorial material is second hand and from commercial sources.

The bibliography is excellent and the book can be recommended for use by teachers but, in the interest of the mental hygiene of students, we hope it is not scheduled as required reading.

BRUNO GEBHARD

Maurice Arthus' Philosophy of Scientific Investigation: *Preface to De l'Anaphylaxie a l'Immunite, Paris, 1921. Translated from the French, with an Introduction by Henry E. Sigerist. Foreword by Warfield T. Longcope. Baltimore: Johns Hopkins Press*, 1943. 26 pp. Price, $.75.

Here in only seventeen pages is epitomized the full spirit of research. It is a translation of the preface of Arthus' famous *De l'Anaphylaxie a l'Immunite*. We owe a real debt of gratitude to Dr. W. T. Longcope, Professor of Medicine, and to Dr. Henry E. Sigerist, Professor of the History of Medicine at Johns Hopkins, for recognizing the scientific and literary value of this gem. Their ardent sponsorship and Sigerist's colorful translation provide its very appropriate setting.

With deft precision Arthus outlines the principles of all experimental methods: "Observe facts, conceive a hypothesis, determine its value through . . . experiments . . . give the interpretation . . . and ascertain the excellence of this interpretation through strict criticism; generalize the results experimentally. . . ." He gives a stern rebuke to those who follow the primrose path: "Seek facts and classify them . . . and you will be the workmen of science. Conceive or accept theories . . . and you will be their politicians."

The paper is not written negatively. Arthus shows that pitfalls are to be avoided by honesty, clarity, precision, and self criticism. The final exhorta-

tion to independence and originality is downright evangelical.

This is a perfect gift to the young person who contemplates or has entered upon a scientific career. Arthus does not emanate the glamor of the pseudo-scientist but in this booklet provides an eternal inspiration and beacon. Sigerist most aptly describes Arthus's service to the neophyte scientist: "His honesty, his fanatical devotion to science, his insistence on originality and last but not least his method, still the most promising one today, will provide them with guidance and will renew their faith in the dark hours of discouragement through which every researcher must go."

This attractive presentation by the Johns Hopkins Press is also sturdy. It is a booklet to be cherished and preserved.

CHARLES EDWARD SMITH

Understanding Juvenile Delinquency—*Children's Bureau Publication 300.* 52 pp. Price, $.10.

Controlling Juvenile Delinquency—*Children's Bureau Publication 301.* 28 pp. Price, $.10. *Washington: U. S. Department of Labor, Children's Bureau,* 1943.

These helpful pamphlets complete a series of three issued by the U. S. Children's Bureau on the recommendation of the Children's Bureau Commission on Children in Wartime. As the war has progressed the problem of juvenile delinquency has become more and more acute. Communities throughout the country have been attempting to control juvenile delinquency with very little success in the present emergency. It is first necessary to have clearly in mind what juvenile delinquency really is, and the factors which contribute to it. These pamphlets meet both of these demands.

It is pointed out that "In wartime, as in peacetime, juvenile delinquency results from our failure to satisfy the basic needs of children and youth—the need for security and for opportunity for growth and development."

The factors contributing to delinquency are well set forth in this series and the community resources which may be tapped are emphasized in the section on Prevention and Treatment. The pamphlets are practical rather than theoretical and deserve wide circulation at this critical time.

RICHARD A. BOLT

Health and Hygiene—*By Lloyd Ackerman. Lancaster, Pa.: Jaques Cattell Press,* 1943. 895 pp. Price, $5.00.

The author has attempted to provide a book that appeals to mature minds in all walks of life. He believes that institutions of higher learning err in offering hygiene to freshmen, in that they are unprepared to understand the problems of health and disease and to grasp the possibilities of obtaining and maintaining health.

The field of personal health is well covered, except that in the industries. Unusual emphasis is given to the rôle of the mental and emotional aspects of health. In fact, the reader is likely to come to the conclusion that these are the major factors in obtaining and maintaining health.

After introductory chapters on the hygienic concept and the causative agents in health, disease, and death, the author treats of the evolution of health concepts and practices, and evaluates these. Next follow chapters on parasitism and hypersensitiveness, nutrition, emotions and the intellect, and the hygiene of the sexual life. Lastly he treats of the exogenous poisons and physical agents in their relation to health.

The author is to be commended for presenting clearly both sides of controversial questions. The frequent use of

technical terms that are not familiar to the general reader leads to the suggestion that a glossary be added to this excellent treatise.

The chapter on the evaluation of health procedures should be read widely by those who are skeptical of the methods of science.

EDWARD C. SCHNEIDER

Allergy Anaphylaxis and Immunotherapy—*Basic Principles and Practice—By Bret Ratner. Baltimore: Williams & Wilkins,* 1943. 834 pp. Price, $8.50.

The book is described in the subtitle, "A treatise presenting the fundamental principles and practice governing the use of antisera, vaccines, toxoids, blood transfusions, blood substitutes and sulfonamides, in the prevention and treatment of infectious diseases and of the allergic phenomena resulting from their use."

In Book I, the practitioner, who makes use of these prophylactic and therapeutic agents will find lucid and informative discussions of their nature, source, methods of preparation and of administration, in forty-odd infections. This part of the book should be a useful supplement to the chapters on infectious diseases in the textbooks of medicine and of the pediatrics.

Book II contains an excellent comprehensive, thoughtful, and practical discussion of serum allergy in all its phases. Drug allergy and transfusion reactions are covered briefly but adequately. There are few physicians, allergists excepted, who will not find this portion of the book illuminating and useful.

There is little in Book III which is not found in the recent textbooks of allergy.

On the whole, the book is worth while. It is well planned and well presented. A few minor criticisms are in order, however. The studies of Cooke, Loveless, Hampton, Sherman, *et al.*, of the thermostable or blocking antibody should certainly have been discussed. The studies of Karelitz and Glorig on serum sickness may have appeared too late (August, 1942), for inclusion. The author's arteriolar spasm theory of wheal formation has been discredited. Book III has more academic than practical interest. None of these detract significantly from the value of the book. OSCAR SWINEFORD, JR.

Ohio River Pollution Survey—*Final Report to the Ohio River Committee. Federal Security Agency, U. S. Public Health Service, Cincinnati, Ohio,* 1942. 793 pp.

The final report of the U. S. Public Health Service has just been made to the Ohio River Committee. This committee was appointed by the Secretary of War under authority granted by the River and Harbor Act of August 26, 1937, to supervise a study of Pollution in the Ohio River Basin. The committee consisted of a representative of the Corps of Engineers, United States Army, Brigadier General T. M. Robins (first representative was Brigadier General Max C. Tyler); a member of the United States Public Health Service, R. E. Tarbett; and a non-government expert, Dr. Abel Wolman. The survey was designed to ascertain what pollution substances are being deposited, directly or indirectly, and the sources and extent of such deposits, with a view to determining the most feasible method of correcting and eliminating the pollution.

In the Public Health Service report to the committee, separate statements are made on the findings for the main Ohio River, the minor tributary basins, and on 19 major tributary basins. The report includes 6 supplements, outlining in some detail the following phases of the study: Collection of Data on Sources of Pollution, Laboratory, Or-

ganization and Methods, Acid Mine Drainage, Industrial Waste Guides, Epidemiological Studies, Biological Studies.

The report is especially significant because it is the first pollution study of a complete large river basin (including all of its tributaries) in the United States, covering some 204,000 square miles. A technical staff of 95 engineers, chemists, and bacteriologists, together with personnel from the various state health departments and the Tennessee Valley Authority, spent over 4 years in the collection and analyses of the data. These studies are valuable not only because of the completeness of the data collected on the Ohio River Basin, but because the technics used will serve for many years as a guide for similar and comparable studies of other river basins. The Corps of Engineers has also made its report to the committee and a joint report with recommendations and cost estimates for comprehensive control measures has been made by the committee to Congress as instructed in the Act. The complete report will be available later in printed form.

ALFRED H. FLETCHER

Health for the Having—*A Handbook for Physical Fitness—By William R. P. Emerson, M.D. New York: Macmillan,* 1944. 146 pp. Price, $1.75.

The author dedicated this pocket size book of 146 pages "to the thousands of our youth whose greatest disappointment has been their rejection for active duty in all branches of our armed forces because of physical unfitness." Since our future existence depends upon man power, Dr. Emerson emphasizes the necessity of improving physical and mental stamina. In 15 chapters he offers advice on how this can be done.

The physician can correct physical defects, but the individual only can correct faulty health habits. He states that "after middle life our chances of reaching old age are no greater than 50 or 100 years ago." Therefore he explains what steps are necessary for individuals to take in order to prevent crippling degenerative diseases and also to attain and maintain high buoyant health.

Discussion centers on such subjects as physical fitness examination, weight, blood pressure, health habits, starving amidst plenty, overwork, time budgeting, the American school system and health, and longevity—14 pages in the appendix give tables of various kinds. This is a book for lay adults. It touches briefly on many health subjects of common interest.

W. W. PETER

Physical Fitness for Boys—*By Ben Miller, Karl W. Bookwalter, and George E. Schlafer. New York: Barnes,* 1943. 457 pp. Price, $3.00.

Physical fitness teachers and supervisors are provided with a useful directing instrument in this book. Provision for details of planning and evaluation of programs and of student progress are well indicated. Emphasis is placed on need for continuity of physical fitness programs in student development. Activities from which selection may be made for adequate programs under differing circumstances are offered. Details of administration, including a realistic proposal of record forms, represent a contribution.

General legal and moral responsibilities of the school in physical fitness are brought forward, for instance, in school accidents. Suggestions for qualifications of staff, improvement of staff, maintenance of morale, evaluation of instruction, and program promotion should be found useful.

While basic individual health is mentioned as a requisite in these programs, the text does not cover methods of securing the coöperation of public health,

medical, dental, nursing, and other health groups. Health evaluation of individuals and groups as a concomitant of physical fitness is not provided. Disease prevention and health education in the program are inadequately treated. Provisions for handling those physically inadequate are not detailed. More adequate treatment of problems, such as fatigue and nutrition, in relation to physical efficiency, might well have been expected. Methodology and plans for coördination of school programs with community and industrial recreation organizations might have been included.

F. M. HEMPHILL

A Guide to Practical Nutrition—*Edited by Michael G. Wohl, M.D., and John H. Willard, M.D. Sponsored by the Committee on Nutrition and Deficiency Diseases of the Philadelphia County Medical Society, Philadelphia, Pa.*, 1943. 98 pp. Distributed to physicians.

The Committee on Nutrition and Deficiency Diseases of the Philadelphia County Medical Society has prepared for the medical profession a convincingly written 98 page book which is not just another recital of nutrition fundamentals. The points covered show the result of careful discrimination whereby only facts which apply directly to the everyday medical problems are included, with special emphasis on those subclinical conditions which are now recognized to be just as important as a definite pathological deficiency disorder.

Throughout the text is an appeal to every physician to use this newer knowledge of nutrition to educate the public to appreciate the importance of proper nutrition as a means of promoting the physical improvement of the individual for the welfare of America. "*A Guide to Practical Nutrition* is to be considered part of a program of public health education—not as a complete coverage of the field of nutrition."

Dr. Morris Fishbein says in the Introduction: "Until adequate knowledge of deficiency diseases and scientific nutrition becomes the property of all members of the medical profession, the utmost that can be accomplished in this field will not be accomplished."

The book consists of 13 papers written by 12 different people, all but two of whom are physicians. One of these physicians who wrote the section on Nutritional Aspects of Dental Disease also is a dentist. Although the subject is addressed to the physician, the book will be of value to nurses, nutritionists, teachers of home economics, and others who have the background to enable them to interpret its scientific terms.

LUCY H. GILLETT

Expectantly Yours—*A Book for Expectant Mothers and Prospective Fathers—By Mario A. Castallo, M.D., and Audrey Walz. New York: Macmillan*, 1943. 110 pp. Price, $1.75.

Among many books for expectant mothers and fathers, *Expectantly Yours* is unique in two ways: it gives more background, setting, and general orientation to maternity than is usual in such small space, and it is written definitely for the well-read, sensitive patient who can profit by information on a higher level of knowledge than is usually offered. The authors use such phrases as "chemical affinity," "salivation," "involution," and touch on such topics as sex determination, syphilis and gonorrhea, forceps delivery, and caudal anesthesia.

Withal, this work is practical, scientifically sound and direct, and it is so entertainingly written that it will not be put down.

DOROTHY DEMING

A SELECTED PUBLIC HEALTH BIBLIOGRAPHY WITH ANNOTATIONS

RAYMOND S. PATTERSON, PH.D.

Sour Public Health Note—In 1943, Mr. and Mrs. United States and most of the little U. S.'ers smoked 257 billion (note the "b" please) cigarettes. The additional billions sent tax free to our soldiers are not counted. Per capita the annual figure is 1,877, and each year it increases hugely. Please complete your own annotation.

ANON. Tobacco Consumption in the United States. J.A.M.A. 125, 3:213 (May 20), 1944.

Germicidal Mists—Maintenance of glycol vapors in adequate concentration is possible in large spaces, but some means of air agitation is desirable, and a minimum relative humidity of 40 per cent is necessary.

BIGG, E., *et al.* The Use of Glycol Vapors for Bacterial Control in Large Spaces. Am. J. M. Sc. 207, 3:361 (Mar.), 1944.

Hospitals, Health Departments and Health—If health facilities—preventive and curative—are to be distributed equitably, there is need, in each country, for a national health service with a central, or federal, agency responsible for all aspects of national hygiene. How hospitals might fit into this scheme is the nub of this paper. Though the arguments are persuasive, there will be some who will agree only that there should be a national health service in every country—except the U.S.A.

DRAPER, W. F. Hospitals in the Public Health Panorama. Pub. Health Rep. 59, 16:513 (Apr. 21), 1944.

Pudding's Proof—In Iceland there is an epidemic of whooping cough about every 7 years. Almost every susceptible child catches it, then the conflagration dies out for lack of fuel. In the face of the latest visitation 5,000 Reykjavik children were quickly vaccinated. Percentage-wise this is what happened: compared to controls nearly 6 times as many of the protected children escaped altogether; in each group half the children had mild infections (no whoop); mediumly severe infections were twice as common among the controls; and gravely severe infections more than double.

DUNGAL, N., *et al.* Vaccination Against Whooping Cough. J.A.M.A. 125, 3:200 (May 20), 1944.

Gonorrhea Should Go—Another note reminding us that penicillin really does cure gonorrhea—if given in sufficient dosage. This is good news for the v.d. controllers, for the drug is now to be available for civilian use too, apparently.

FERGUSON, C., and BUCHHOLTZ, M. Penicillin Therapy of Gonorrhea in Men. J.A.M.A. 125, 1:22 (May 6), 1944.

Department of Stray Facts—Miscellaneous information to add to your little store of knowledge: When rabbits are injected with diphtheric toxoid incorporated in lanolin, antitoxin formation is enhanced and prolonged, as compared with plain toxoid. Paraffin oil enhances antibody formation against typhoid bacilli and killed tubercle bacilli have an additional synergistic effect. There isn't much you can do with this intelligence at the moment.

FREUND, J., and BONANTO, M. V. The Effect of Paraffin Ail, Lanolin-like Substances and Killed Tubercle Bacilli on Immunization with Diphtheric Toxoid and *Bact. Typhosum.* J. Immunol. 48, 5:325 (May), 1944.

More Evidence That Generalized Nursing Is Practical—For twenty years Berkeley (Calif.) has carried on a unified, generalized nursing program. This report tells about the school, public health, and visiting nursing services which each of the staff members performs. The plan is fundamentally sound and provides the community with the most efficient service at the lowest possible cost, concludes the writer.

GILCREST, E. W. A Unified Service of Long Standing. Pub. Health Nurs. 36, 4:164 (Apr.), 1944.

Alcoholism as a Public Health Problem—Part one gives promise that this series will be unusually interesting and provocative. It is a dissertation on present-day scientific research in the field of alcohol studies, the outgrowth of a good deal of pseudo-science undertaken to prove the wishful beliefs of pros or antis. What I like about the paper is its tone—it is written with a reasonableness that is most reassuring.

JELLINEK, E. M. Alcohol Research—Theoretical and Practical. Pub. Health Nurs. 36, 5:223 (May), 1944.

Uses of Cancer Reports—Is the cancer reporting game worth the statistical candle in respect to the light it sheds? The arguments against reporting are well known and are frequently aired. There seems to be a good case for reporting in this account of three years' experience in New York State.

LEVIN, M. P. Cancer Reporting in New York State. New York J. Med. 44, 8:880 (Apr. 15), 1944.

" Better Health for the People "—What sort of black magic, do you suppose, boils up through that wholly imaginary line marking the Canadian-American border which permits the reasonable men on the north side, who govern the affairs of the Canadian medical association, to think and talk about public medical services with equanimity, while equally reasonable men south of the line, who decide the affairs of our medical association, see red whenever the word social medicine is mentioned? The paper prompting this impertinent speculation is about integrated health and medical services in Canada.

LEWIS, D. S., and JACKSON, F. W. The Integration of Preventive and Curative Medicine in Health Insurance. Canad. Pub. Health J. 35, 3:99 (Mar.), 1944.

Healthy Skepticism about Nutrition—A Doubting Thomas *sp. Canadensis* looks critically at the spurious accuracy which seems to be the basis for a good many of the nutritional standards set up by certain Canadian authorities. Where, he asks, are the data to support the recommendation that a man must have 75 mg. of ascorbic acid, but a woman only 70 mg.? That is only a single sample. One wonders if our straight-faced, American pronouncements have been scrutinized with equal objectivity.

MCHENRY, E. W. Recent Trends in Nutrition. Canad. Pub. Health J. 35, 4:154 (Apr.), 1944.

About a Neglected Step-child—Time was when the educational movie enjoyed a prominent place in the affections of us sanitarians. With certain notable exceptions among our health agencies, it is safe to assume that health movies are being neglected today, yet American military authorities and Canadian and British civil authorities are making increasing use of training and documentary films. This paper suggests what may be wrong with our unsatisfactory health " squeakies."

NICHTENHAUSER, A. Planned Health Film Production. J. Health & Phys. Educ. 15, 5:251 (May), 1944.

Tomorrow's Defenses against Disease—Pointing out the interdependence of military and civilian public

hygiene and the steps being taken to secure a healthy citizenry in support of a healthy soldiery, the Surgeon General suggests that the future of medicine may be in the hands of the thousands of physicians now in the military and naval services. Concentrated there are the youngsters who have the greatest stake in that future. Having become used to the best facilities of modern group medicine they may be loath to return to a " horse and buggy " medical economy.

PARRAN, T. Teamwork on the Health Front. Mil. Surgeon. 94, 2:76 (Feb.), 1944.

Antidote for Rose-colored Spectacles—We have started toward the greatest epidemic of gonorrhea that our country has ever experienced, says this man who sees all sides of this problem and warns against the easy assumption of cure after a brief course of sulfonamides.

PELOUZE, P. S. Gonorrhea: The Epidemic We Face. Ven. Dis. Inform. 25, 3:76 (Mar.), 1944.

Enormous in Scope and Complex in Character—Eleven papers presenting up-to-the-minute solutions for problems in industrial health. Tuberculosis, factory sanitation, nutrition, eyesight conservation, rehabilitation, and vocational training are some of the timely topics discussed in this symposium, which every interested health worker quite naturally will read.

SEEGER, S. J., *et al.* Sixth Annual Congress on Industrial Health. J.A.M.A. 125, 4:239 (May 27), 1944.

Without Benefit of Kenny—So much has been written about the superiorities of the Kenny treatment, that there will be interest in the outcome of some recent Chicago cases in which orthodox methods were employed. Roughly, three-quarters of the patients had no, or barely detectible, residual weakness at the end of care.

SHERMAN, M. S. The Natural Course of Poliomyelitis. J.A.M.A. 125, 2:99 (May 13), 1944.

Worms, *et al.*—From the parasite-infested corners of the earth our military personnel will return with a cumulative load of tropical diseases unequalled since the days of slave-trading, cheerfully prophesies this writer. What to do about protozoal diseases, and nematode, cestode, and trematode infestations is the timely burden of this paper.

WRIGHT, W. H. Present and Post-War Health Problems in Connection with Parasites. Science. 99, 2568:207 (Mar. 17), 1944.

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POPULATION TRENDS IN ALLEGHENY COUNTY. Pittsburgh: Bureau of Social Research, Federation of Social Agencies of Pittsburgh and Allegheny County, 1944. 48 pp. Price, $.50.

THE MANAGEMENT OF NEUROSYPHILIS. By Bernard Dattner. New York: Grune & Stratton, 1944. 398 pp. Price, $5.50.

RADIATION AND CLIMATIC THERAPY. Edited by Edgar Mayer. Baltimore: Williams & Wilkins, 1944. 393 pp. Price, $5.00.

TUBERCULOSIS OF THE EAR, NOSE AND THROAT. By Mervin C. Myerson. Springfield, Ill.: Thomas, 1944. 291 pp. Price, $5.50.

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NOTES ON NURSING BY A NURSE. By Sarah Corry. Illus. New York: Appleton-Century, 1944. 160 pp. Price, $1.50.

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ATLAS OF HUMAN ANATOMY. By Franz Frohse, Max Brodel, and Leon Schlossberg. New York: Barnes & Noble, 1944. 86 pp. Price, cloth-bound, $2.25. Paper-bound, $1.50.

ANNUAL REVIEW OF PHYSIOLOGY. By American Physiological Society and Annual Reviews. (Vol. VI.) Stanford, Calif.: Annual Reviews, 1944. 630 pp. Price, $5.00.

ANALYTICAL CHEMISTRY OF INDUSTRIAL POISONS, HAZARDS AND SOLVENTS. By M. B. Jacobs. (Vol. I, 2nd ed.) New York: Interscience Publishers, 1944. 661 pp. Price, $7.00.

WARTIME HEALTH AND EDUCATION. Hearings before a Subcommittee of the Committee on Education and Labor, United States Senate. (Part II.) Washington: U. S. Government Printing Office, 1944. Pp. 601–1048, incl.

THE FORTY-THIRD YEARBOOK OF THE NATIONAL SOCIETY FOR THE STUDY OF EDUCATION. Prepared by the Society's Committee. Part I. Chicago: Department of Education, the University of Chicago, 1944. 354 pp. Price, $2.25.

THE BABY MANUAL. By Herman N. Bundesen. New York: Simon and Schuster, 1944. 590 pp. Price, $3.00.

HEALTH FOR YOUNG AMERICANS. By William E. Burkard, Raymond L. Chambers, and Frederick W. Maroney. Illus. New York: Lyons & Carnahan, 1943. 375 pp. Price, $.75.

THREE FRIENDS. By Elizabeth Montgomery and Dorothy Baruch. Illus. New York: Scott, Foresman, 1944. 160 pp. Price, $.84.

ASSOCIATION NEWS

SECOND WARTIME PUBLIC HEALTH CONFERENCE AND SEVENTY-THIRD ANNUAL BUSINESS MEETING AMERICAN PUBLIC HEALTH ASSOCIATION

New York, N. Y., October 3–5, 1944
Headquarters: Hotel Pennsylvania

RATES QUOTED BY NEW YORK HOTELS

Second Wartime Public Health Conference and Seventy-third Annual Business Meeting—October 3–5, 1944

	Rooms Without Bath		*Rooms With Bath*	
	Single	*Double*	*Single*	*Double*
Headquarters:				
Pennsylvania, 7th Ave. & 33rd St.			$3.85– 6.60	$5.50– 8.80
Hotels near Hotel Pennsylvania:				
Governor Clinton, 7th Ave. & 31st St.			3.30– 5.50	4.40– 7.70
Martinique, Broadway & 32nd St.	$2.00–2.50	$3.00–4.00	2.75– 3.85	3.85– 5.95
McAlpin, Broadway & 34th St.	2.20–2.75	3.85–4.40	3.30– 6.60	4.95– 8.80
New Yorker, 8th Ave. & 34th St.			3.85– 8.80	5.50–11.00
Allerton House, 143 East 39th St.	2.00–2.25		2.75– 3.00	
Allerton House for Women, 130 East 57th St.	2.00–2.50		3.00– 3.50	
Ambassador, Park Ave. & 51st St.			6.00– 8.00	$8.00–10.00
Astor, Broadway & 44th St.			3.50– 5.00	6.00– 8.00
Barbizon (Women), Lexington Ave. & 63rd St.	2.00–2.75	3.50–4.50	3.25– 3.75	4.50– 5.50
Barclay, 111 East 48th St.			6.00– 7.00	8.00–10.00
Belmont Plaza, Lexington Ave. & 49th St.			4.00– 5.50	6.00– 8.00
Beverly, Lexington Ave. & 50th St.			5.00– 6.00	7.00– 8.00
Biltmore, Madison Ave. & 43rd St.			5.50–12.00	7.50–14.00
Bristol, 129 West 48th St.	1.75–2.00	3.00	2.50– 4.00	3.50– 6.00
Capitol, 8th Ave. & 51st St.	2.50		3.50– 4.00	5.00– 6.00
Carlyle, Madison Ave. & 76th St.			6.00– 7.00	8.00– 9.00
Chesterfield, 130 West 49th St.	1.50–2.00	2.50–3.00	2.50– 3.00	4.00– 6.00
Commodore, Lexington Ave. & 42nd St.			3.50– 5.50	5.50– 8.80
Concourse Plaza, Grand Concourse & 161st St.			3.50– 4.50	5.50– 6.50
Cornish Arms, 311 West 23rd St.			2.25– 3.00	4.00– 4.25
Essex House, 160 Central Park South			6.00– 8.00	8.00–10.00
Fifth Avenue Hotel, 24 Fifth Ave. (9th St.)			5.00– 6.00	7.00– 8.00
Henry Hudson, 353 West 57th St.			2.50– 3.00	3.50– 5.00
Kenmore Hall, 145 East 23rd St.	1.50–2.00	2.50–3.00	2.00– 3.50	3.50– 5.00
Lexington, 48th St. & Lexington Ave.			4.00– 6.00	6.00– 8.00
Luxor Baths Hotel, 121 West 46th St.			2.25– 2.75	4.50– 5.50
Midston House, 22 East 38th St.	2.25–2.50		3.50	4.00– 4.50
New Weston, Madison Avenue & 50th St.			4.00– 6.00	6.00– 9.00
Paramount, 46th St. West of Broadway			3.00– 4.50	4.00– 8.00
Park Central, 7th Ave. & 55th St.			4.00– 5.00	6.00– 8.00
Parkside, 18 Gramercy Park South	2.25		2.75– 3.30	5.00– 6.00
Piccadilly, 227 West 45th St.			3.00– 4.00	4.50– 6.00
Plymouth, 143 West 49th St.			2.50– 3.50	4.00– 5.00
President, 234 West 48th St.			2.50– 4.00	4.00– 5.00
Prince George, 14 East 28th St.			2.50– 4.00	4.00– 7.00
Roosevelt, Madison Ave. & 45th St.			4.50– 8.00	6.50–12.00
Shelton, 49th St. & Lexington Ave.	2.50		3.50– 5.00	5.00– 7.00
Taft, 7th Avenue & 50th St.	2.00–2.50	3.50–4.00	2.50– 5.00	3.50– 8.00
Times Square, 43rd St. & 8th Ave.	2.00–2.50	3.00–3.50	2.25– 3.00	4.00– 5.00
Tudor, 304 East 42nd St.			2.50– 4.00	4.00– 6.00
Victoria, 7th Ave. & 51st St.			3.00– 4.00	4.50– 7.00
Waldorf-Astoria, 50th St. & Park Ave.			7.00–10.00	10.00–12.00
Warwick, 54th St. & 6th Ave.			5.00– 6.00	7.00– 8.00
Wellington, 7th Ave. & 55th St.			3.00– 5.00	4.00– 7.00
Woodstock, 127 West 43rd St.	2.00–2.50	3.50–4.00	3.00– 5.00	4.00– 7.00

APPLICANTS FOR MEMBERSHIP

The following individuals have applied for membership in the Association. They have requested affiliation with the sections indicated.

Health Officers Section

Charles F. Atkinson, M.D., Court House, Traverse City, Mich., Director, Grand Traverse-Leelanau Health Dept.

Douglas B. Avison, M.D., D.P.H., 293 Ethel St., Kelowna, B. C., Canada, Director, Okanagan Valley Health Unit

Benjamin W. Black, M.D., 2701 14th Ave., Oakland 6, Calif., Alameda County Medical Director

Alvin R. Christopherson, D.M.D., 805 Tribune Bldg., Salt Lake City, Utah, Member, State Board of Health

William D. Cutsungavich, M.D., Holden, Alta., Canada, Medical Officer of Health, Holden Health Unit

Abe J. Davis, M.D., Richmond County Health Dept., Augusta, Ga., Commissioner of Health

George M. Downard, Ph.C., 315 U. S. Custom House, Portland 9, Ore., Inspector, U. S. Food and Drug Administration

John R. Francella, M.D., 227 E. Chestnut St., Coatesville, Pa., Health Officer

Dudley Glen-Campbell, M.B., D.P.H., Tuberculosis Clinic, Kingston, Jamaica, B.W.I., Asst. Tuberculosis Officer, Jamaica Government

Morris Gordon, M.D., 3224 Grand Concourse, New York, N. Y., Tuberculosis Clinician, Bureau of Tuberculosis, Dept. of Health

Carl E. Hill, M.D., 5248 Yonge St., Willowdale, Ont., Canada, Medical Officer of Health, Township of North York

Bernard Hochfeider, M.D., 809 Pere Marquette Bldg., New Orleans 12, La., Physician

John B. Hozier, M.D., M.P.H., 8 Kilsyth Terrace, Brookline, Mass., Surgeon, U. S. Public Health Service; Director, Genito-Infectious Division, Massachusetts Dept. of Public Health

James E. Johnson, M.D., Health Center, 708 Lexington Ave., Fort Smith, Ark., Director, City-County Health Unit

Harold M. Johnston, M.B., M.P.H., Island Medical Office, Kingston, Jamaica, B.W.I., Malaria Officer, Government of Jamaica

Herbert S. Lawrence, D.P.H., Port Maria, Jamaica, B.W.I., Health Officer, St. Mary Government Medical Service

Hyacinth Lightbourne, M.B., D.P.H., 187 Mountain View Ave., Liguanea, Jamaica, B.W.I., Medical Officer of Health, Jamaica Medical Service

John A. Lindquist, M.D., 300 S. 7th St., City Hall, Springfield, Ill., Director of Health

Albert F. Litzenburger, M.D., 411 Pearl St., Boyne City, Mich., Director, Dist. No. 3, Michigan Dept. of Health

Capt. Stephen K. Molnar, M.C., 17010 Tireman, Detroit 10, Mich., Sanitation Officer

Percival C. Murray, M.D., M.P.H., Island Medical Office, Kingston, Jamaica, B.W.I., Medical Officer of Health, Government Medical Service

Alfred A. Peat, M.B., M.P.H., Spanish Town, Jamaica, B.W.I., Medical Officer of Health, Jamaica Government

Dr. Miguel Silva-Martinez, Estacion de Adiestramiento Sanitario, Coatepec, Vera Cruz, Mexico, Asst. Director, Health Training Center

Tennyson B. Sinclair, M.D., D.P.H., Port Antonio, Jamaica, B.W.I., Health Officer, Island Medical Dept.

Edward J. Valentine, M.B., D.P.H., Falmouth, Jamaica, B.W.I., Medical Officer of Health, Jamaica Government Medical Service

H. Garner Wright, M.D., County Court House, Bellingham, Wash., Health Officer, Whatcom County Health Dept.

Otis W. Yeager, M.D., 14th Ave. and Lake St., San Francisco, Calif., Medical Officer, Plague Suppressive Measures, U. S. Public Health Service

Laboratory Section

Josephine Alsworth, 440 Winton St., Jackson, Miss., Bacteriologist, State Board of Health

Leonard E. Arnold, M.D., D.P.H., 4 Ripon Road, Cross Roads, Jamaica, B.W.I., Asst. Government Pathologist and Bacteriologist, Government of Jamaica

Lenora J. Burditt, 5911 Grand Ave., Riverside, Calif., Student, University of California

Major Harry E. Carnes, M.C., Exec. Officer, U. S. Army Medical Laboratory

Virgil F. Chapman, Health Dept., City Hall, Dubuque, Iowa, Sanitary Bacteriologist

William E. Clapper, Ph.D., University of Utah, Salt Lake City, Utah, Asst. Professor of Bacteriology

Anne Craig, 1339 North State, Jackson, Miss., Medical Technician, State Board of Health

Cornelia E. Dingle, 306 Riverway, Boston 15, Mass., Bacteriologist, State Health Dept.

Richard Eglinton, 1179 Main St., Hartford

I. Conn., Chief Microbiologist, Bureau of Laboratories, State Dept. of Health

Kelly H. Eldredge, 1862 Lake St., Salt Lake City, Utah, Teacher of Bacteriology, University of Utah

June F. Gaffney, 1865 Clay St., San Francisco 9, Calif., Laboratory Technician, Southern Pacific General Hosp.

Lt. Milton Goldin, Sn.C., Laboratory Officer, U. S. Army Hospital

Martha K. Hohl, 1834 Delaware St., Berkeley 3, Calif., Bacteriologist, Div. of Labs., State Dept. of Health

Kathleen Hussey, Ph.D., 600 W. 168th St., New York, N. Y., Research Assoc. in Parasitology, DeLamar Institute of Public Health

Barbara J. Klever, 1341 S. Parton St., Santa Ana, Calif., Laboratory Technician, Orange County Health Dept.

Barbara Lang, Box 36, Poquonock, Conn., Sanitary Chemist, State Dept. of Health

Thomas L. Martin, Ph.D., 20 E. 9 North, Provo, Utah, Prof. of Bacteriology, Brigham Young University

Martha Michelbacher, Ph.G., 1701 Thousand Oaks Blvd., Berkeley 6, Calif., Bacteriologist, State Dept. of Public Health

Rosemary L. Noakes, 1307 Second Ave., San Francisco 22, Calif., Laboratory Technician, G. W. Hooper Foundation for Medical Research

Jose E. Ortiz, St. Lukes Hospital, Ponce, Puerto Rico, Medical Technologist

Mrs. Quay DeBure Rice, 154 Mills Ave., Spartanburg, S. C., Medical Technician, Laboratory, Station Hospital, Camp Croft

Lillian Rodofsky, 27 Summer St., Revere, Mass., Asst. in Bacteriology Dept., Tufts Medical School, Boston

Mary E. Rymer, 751 E. Platte Ave., Colorado Springs, Colo., City Chemist and Bacteriologist

Lt. Benjamin Shapiro, Sn.C., 101st General Hospital, Camp Grant, Ill., Laboratory Officer

Mildred B. Talley, 909 Wood Ave., Waco, Tex., Junior Serologist, Waco McLennon County Health Unit Lab.

Shirley E. Wilson, 2846 Forest Ave., Berkeley, Calif., Bacteriologist, Div. of Labs., State Health Dept.

I. Jaques Yetwin, M.D., 148 Crescent St., Waltham 54, Mass., Assoc. Prof. of Parasitology and Tropical Medicine, Middlesex University School of Medicine

Vital Statistics Section

Karl F. Heiser, Ph.D., 203 State Office Bldg., Hartford, Conn., Director of Research, Public Welfare Council

Betty W. King, 614 Central, Salinas, Calif., Vital Statistician, Monterey County Health Dept.

Helen Maher, Tennessee Valley Authority, Chattanooga, Tenn., Statistician, Health and Safety Dept.

Engineering Section

Capt. Amos J. Alter, P. O. Box 2868, Juneau, Alaska, Passed Assistant Sanitary Engineer, U. S. Public Health Service

William C. Blankenship, Pulaski County Court House, Little Rock, Ark., County Sanitarian, Pulaski County Health Dept.

Paul J. Cerny, 603 B.M.A. Bldg., Kansas City 8, Mo., Sanitary Engineer (R), U. S. Public Health Service

Irving F. Gaskin, Office of the Medical Officer of Health, Siparia, Trinidad, B.W.I., Sanitary Inspector, Government Sanitary Services

William V. Hickey, 757 7th Ave., Salt Lake City, Utah, Chief Sanitarian, City Board of Health

Malcolm C. Hope, M.S., 603 B.M.A. Bldg., Kansas City 8, Mo., Passed Assistant Sanitary Engineer (R), U. S. Public Health Service

William A. Legwen, M.S., P. O. Box 1095, Macon, Ga., Passed Assistant Sanitary Engineer (R), U. S. Public Health Service

Harold B. Robinson, M.S., 617 Colorado Bldg., Denver 2, Colo., Passed Assistant Sanitarian, U. S. Public Health Service

Darold W. Taylor, 2124 N. Nevada, Colorado Springs, Colo., Asst. Sanitarian (R), U. S. Public Health Service

George P. Umberger, 2230 K. St., Sacramento, Calif., Sanitarian, Sacramento County Health Dept.

Joseph E. Williams, Summerlee Ave., Oak Hill, W. Va., Sanitarian, State Health Dept.

Industrial Hygiene Section

Arthur V. Diedrich, D.D.S., 14015 Gratiot Ave., Detroit 5, Mich., Chairman, Industrial Dental Programs Committee, State Dental Society

Lt. Col. Jean S. Felton, M.C., Station Dispensary, Fort Mason, Calif., Industrial Medical Officer

J. Brennan Gisclard, M.S., 727 N. Capitol Ave., Lansing 6, Mich., Chief Chemist, Bureau of Industrial Hygiene, State Dept. of Health

Paul D. Halley, 1584 E. Washington St., Charleston 1, W. Va., Assoc. Industrial Hygienist, State Health Dept.

Gertrude A. Stewart, R.N., 4801 Connecticut Ave., N.W., Washington, D. C., Supervisor

Medical Dept., International Business Machines Corp.

N. A. Talvitie, 631 Second Ave., West, Seattle 99, Wash., Industrial Hygiene Chemist, State Dept. of Health

Ella Mae Watson, R.N., 1430 Sacramento St., San Francisco 9, Calif., Industrial Nursing Consultant, State Dept. of Public Health

Food and Nutrition Section

Diamond A. Ballin, M.A., 55 Shattuck St., Boston, Mass., Student, Harvard School of Public Health

William J. Darby, Ph.D., Box 1042, Chapel Hill, N. C., Director of Medical Nutrition, State Board of Health

Clarence L. Edwards, Quincy Health Dept., Quincy, Mass., Food Inspector

Dorothy W. Gaunt, 1505 Harrison Blvd., Boise, Idaho, Nutritionist, American Red Cross

Walker L. Loving, Ph.D., 618 Volunteer Bldg., Atlanta, Ga., Assoc. Sanitarian, U. S. Public Health Service

Maurine Meier, 3200 Eastern, Oklahoma City, Okla., Nutritionist, State Health Dept.

Maternal and Child Health Section

George F. Davidson, Ph.D., 245 Cooper St., Ottawa, Canada, Exec. Director, The Canadian Welfare Council

Lucille J. Marsh, M.D., 3326 Park, Jacksonville, Fla., Director, Bureau of Maternal and Child Health, State Board of Health

Public Health Education Section

Madge Bartlett, P. O. Box 3548, Orlando, Fla., Exec. Sec., Orange County Tuberculosis and Health Assn.

Gladys T. Daniloff, 604 Mission St., San Francisco 5, Calif., Exec. Sec., Heart Committee, San Francisco Tuberculosis Assn.

Arthur H. Estabrook, Ph.D., Room 607, 311 S. Juniper St., Philadelphia, Pa., Sec., Mental Hygiene and Public Health Division, Public Charities Assn. of Pennsylvania

D. Frank Holtman, Ph.D., University of Tennessee, Knoxville, Tenn., Prof. and Head of Dept. of Bacteriology

Frederick E. Kidder, Castaner General Hospital, Adjuntas, Puerto Rico, Director, Public Health Program

Laurence R. Kirk, 2235 N. St., Sacramento, Calif., Exec. Sec., Sacramento Tuberculosis Assn.

Mary E. Leonard, 16 Crockett Ave., Dorchester 24, Mass., Health Education Worker, Southern Middlesex Health Assn.

Helen H. Lynaugh, R.N., Box 150, Bonifay, Fla., County Public Health Nurse, State Board of Health

Randall R. MacLean, M.D., Provincial Mental Hospital, Ponoka, Alta., Canada, General Medical Supt.

Jay E. McCarthy, Room 521, Phelan Bldg., San Francisco 2, Calif., Health Educator, State Dept. of Public Health

Marion L. Meigs, 5 Lodge St., Albany 7, N. Y., Health Education Director, Young Women's Christian Assn.

Robert E. Nims, 824 Fayette Ave., Springfield, Ill., Film Exhibits Technician, State Dept. of Public Health

Arthur C. Painter, 33 Hunt St., San Francisco, Calif., Venereal Disease Educator, San Francisco Dept. of Public Health

Dr. Jose L. Pineda, International House, Berkeley, Calif., Director of Malaria Control, Inter-American Cooperative Health Service

Miriam Rogers, The Stamford Hospital, Stamford, Conn., Tumor Clinic Sec.

Henriette Strauss, Dept. of Preventive Medicine, 615 N. Wolfe, Baltimore 5, Md., Director of Visual Health Education, Johns Hopkins Medical School

Margaret A. Walcott, M.A., 203 County Court House, Pensacola, Fla., Exec. Sec., Escambia County Tuberculosis and Health Assn.

Public Health Nursing Section

Aline Batson, 5926 Perrier St., New Orleans, La., Field Supervisor, Child Welfare and Community Health Assn.

Lora I. Battin, 527 Broadway, Quincy, Ill., Supervising Nurse, Adams County Defence Zone Health Dept.

Alice Christianson, M.P.H., 305 Greenwood, Topeka, Kans., Asst. Public Health Nursing Consultant, U. S. Public Health Service

Idabel Durgan, R.N., 325 N. Cleveland St., Orange, Calif., Director of Public Health Nurses, Orange County Health Dept.

Gertrude M. Embury, 606 Spencer Ave., Santa Rosa, Calif., Supervisor of Public Health Nurses, Richmond Health Dept.

Grace W. Fisher, R.N., Ravenswood, W. Va., Public Health Nurse, State Health Dept.

Helen E. Kinney, A.M., 6172 Delafield Ave., New York 63, N. Y., Instructor, Public Health Nursing Dept., Seton Hall College

Nettie Kirchhoff, R.N., Nursing Div., State Dept. of Health, Austin, Tex., Field Supervising Nurse

Ruth Laine, 1822 Unionport Rd., New York, N. Y., Supervisor of Welfare Room, American Red Cross

Christine Mackenzie, M.A., R.N., 1455

Lincoln Way, San Francisco 22, Calif., Asst. Prof. in Public Health Nursing, University of California

Lida S. Murphy, R.N., P. O. Box 71, Lakeport, Calif., Lake County Public Health Nurse

Christiana Olafson, R.N., Hays Sub-Agency, Hays, Mont., Public Health Nurse, U. S. Office of Indian Affairs

Coretta Pharris, 640 Brady St., Apt. 202, Dearborn, Mich., Staff Nurse, Wayne County Health Dept.

Anne Poore, R.N., 114 Morningside Drive, New York, N. Y., Asst. Supervisor, Henry Street Visiting Nurse Service

Jane B. Taylor, R.N., 703 Harrison St., Topeka, Kans., Venereal Disease Nursing Consultant, State Board of Health

Maisie Wetzel, M.S., 1206 S.W. Gibbs, Portland, Ore., Asst. Director of Nursing Education, University of Oregon Medical School

Charlotte E. Wilson, 242½ Glendale Blvd., New Orleans 20, La., Supervisor of Nurses, City Health Dept.

Lulu K. Wolf, R.N., 2014 Cedar Lane, Nashville 4, Tenn., Prof. of Nursing Education, Vanderbilt University School of Nursing

Epidemiology Section

David A. Cooper, M.D., 1520 Spruce St., Philadelphia 2, Pa., Chief, Div. of Tuberculosis, City of Philadelphia

W. Derrel Hazlehurst, M.D., County Health Dept., Fayetteville, N. C., Passed Assistant Surgeon, U. S. Public Health Service

Major Oliver R. McCoy, M.C., 2806 31st St., S.E., Washington, D. C., Director, Tropical Disease Control Div., Office of the Surgeon General, U. S. Army

Lt. Col. Thomas H. Sternberg, M.C., 1818 H. St., N.W., Washington, D. C., Director, Venereal Disease Control Div., Preventive Medicine Service, Office of the Surgeon General, U. S. Army

Major Douglass W. Walker, M.C., 4816 29th St., South, Arlington, Va., Exec. Officer, Preventive Medicine Service, Office of the Surgeon General, U. S. Army

Luke M. Watson, M.B., M.P.H., Health Dept., Kingston and St. Andrew, Cross Roads P. O., Jamaica, B.W.I., Medical Officer of Health

Charles C. Wedderburn, M.B., M.P.H., 4 Stanton Terrace, Liguanea P. O., Jamaica, B.W.I., Venereal Disease Control Officer, Jamaica Government Medical Service

Herbert A. Wenner, M.D., Yale University Dept. of Prev. Med., New Haven, Conn., Instructor in Preventive Medicine

School Health Section

Abraham Braverman, M.D., 1931 Vyse Ave., Bronx, N. Y., Medical Inspector of Schools, City Health Dept.

Margaret A. Cree, 509 Phelan Bldg., San Francisco, Calif., Maternal and Child Health Nursing Consultant, State Dept. of Public Health

William J. Dougherty, M.D., 101 N. Railroad Ave., Frackville, Pa., Medical Inspector, Frackville Schools

Herman B. Katzman, M.D., 665 Ocean Parkway, Brooklyn, N. Y., Cardiologist, City Health Dept.

Philip Ollstein, M.D., 1015 Washington Ave., Brooklyn 25, N. Y., Supervising School Physician, City Health Dept.

Virginia M. Palmer, M.D., 2 Herbert Ave., White Plains, N. Y., School Physician, White Plains Public Schools

Ethel H. Priest, M.D., Napa Junior College, Napa, Calif., School Physician

Clara S. Shepherd, M.D., City Health Board, City Hall, Lansing, Mich., School Physician

Lloyd E. Webster, M.A., 808 North Spring St., Los Angeles 12, Calif., Director, Div. of School Health Education, Los Angeles County Schools

Dahlia Whitbourne, M.B., Public Health Office, Cross Roads P. O., Jamaica, B.W.I., Asst. Medical Officer of Health, Kingston and St. Andrew Corp.

Dental Health Section

Max K. Baklor, D.D.S., 2201 Eutaw Place, Baltimore 17, Md., Lecturer in Dental Hygiene, School of Nursing, Sinai Hospital

Dr. Stanley C. Brown, Ithaca, Mich., Dentist

Russell W. Bunting, D.D.S., 916 Church St., Ann Arbor, Mich., Dentist

L. A. Cadarette, D.D.S., 630 E. Jefferson, Detroit 26, Mich., Dentist

Crown O. Diehl, D.D.S., 208 Professional Arts Bldg., Hagerstown, Md., Vice President, Washington County Public Health Assn.

Kenneth R. Gibson, D.D.S., M.S.P.H., 660 Frederick St., Detroit 2, Mich., Director of Dentists, Childrens Fund of Michigan

Sophie Gurevich, D. C. Health Dept., 300 Indiana Ave., N.W., Washington 1, D. C., Senior Public Health Dental Hygienist, Bureau of Dental Services

Herbert F. Hess, D.D.S., 9400 Euclid Ave., Cleveland, Ohio, Asst. Supervisor of Mouth Hygiene, Cleveland Public Schools

Phoebe Jarvi, 2750 North Cramer St., Milwaukee 11, Wis., Dental Hygienist, Milwaukee Childrens Hospital

Walter C. McBride, D.D.S., 660 Fisher Bldg., Detroit 2, Mich., Dentist

Frank J. McClure, Ph.D., National Institute of Health, Bethesda, Md., Senior Biochemist

John P. Riedel, D.D.S., P. O. Box 448, Fresno 9, Calif., Supervising Dentist, State Dept. of Public Health

Thomas N. Talty, D.D.S., 1535 S. Kimbrough, Springfield, Mo., Staff Member, Metro Dental Clinic

Dr. Drew H. Turner, Box 210, Jacksonville, Fla., Director, Bureau of Dental Health, State Board of Health

Marcus L. Ward, D.D.S., 1308 Cambridge Rd., Ann Arbor, Mich., Johanathan Taft Professor of Dentistry, School of Dentistry, University of Michigan

Unaffiliated

Charlotte Andress, A.M., 6151 South Drexel, Chicago, Ill., Instructor, Dept. of Public Health Nursing, Loyola Univ.

George Bugbee, 18 E. Division St., Chicago 10, Ill., Exec. Sec., American Hospital Assn.

Seymour M. Farber, M.D., San Francisco Hospital, Portero and 23rd St., San Francisco, Calif., Teacher, University of California Medical School, Dept. of Medicine

James Lieberman, D.V.M., 29–05 Parsons Blvd., Flushing, N. Y.

Helen Paull, 1228 N. Broadway, Santa Ana, Calif., Physiotherapist, County Health Dept.

Mildred C. J. Pfeiffer, M.D., 6830 Old York Rd., Philadelphia 26, Pa., Physician, Community Health Center

DECEASED MEMBERS

Meta DeLoache, Paterson, N. J., Elected Member 1941, Public Health Education Section

Aurelia B. Potts, R.N., Nashville, Tenn., Elected Member 1928, Elected Fellow 1934, Public Health Education Section

Dr. Rafael Silva, Mexico City, Mexico, Elected Member 1930, Health Officers Section

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CLIFFORD C. YOUNG, D.P.H.

Dr. C. C. Young, for many years Director of Laboratories, Michigan State Health Department, died on June 5.

Dr. Young was born in Kansas, and educated at the University of Rochester and the University of Kansas. He received the degree of Doctor of Public Health from the University of Michigan in 1924. His vision and energy have placed the Michigan State Health Department Laboratories among the most outstanding in the country.

Dr. Young was elected to membership in the Association in 1912. He was a charter Fellow. He served three terms on the Governing Council, was Chairman of the Laboratory Section in 1928, and Chairman of the Committee on Meetings and Publications from 1930 to 1935. He was a member of the Executive Board at the time of his death, having been elected for a three year term in 1941.

CLOSING DATE FOR SUBMITTING FELLOWSHIP APPLICATIONS

Members who may be interested in applying for Fellowship in the A.P.H.A. are hereby advised that Fellowship applications should be received by the Central Office not later than August 1, to insure consideration at the Second Wartime Public Health Conference and 73rd Annual Business Meeting to be held in New York October 3 to 5.

EMPLOYMENT SERVICE

The Association Employment Service seeks to bring to the attention of appointing officers the names of qualified public health personnel and to act as a clearinghouse on employment. This is a service of the Association conducted without expense to the employer or employee.

From the registry of persons available, selected announcements are published from time to time. Appointing officers may obtain lists of all registrants on request.

Address all correspondence to the Employment Service, American Public Health Association, 1790 Broadway, New York 19, N. Y.

POSITIONS AVAILABLE

Wanted: A physician trained in tuberculosis to assume administrative control of the Bureau of Tuberculosis in an eastern city of 200,000 population. Salary $4,500–$5,031 plus cost of living adjustment. Address **Box B**, Employment Service, A.P.H.A.

Michigan announces civil service positions now open for orthopedic public health nurse, Grades II and III classes with the Michigan Crippled Children's Commission. Salary range: Grade II $230 to $270 per month; Grade III $280 to $340 per month. Grade II not under 23, Grade III not under 25. Must have completed course in orthopedic nursing or physical therapy in approved school. For Grade III position a full-time course of at least 9 months' duration is required. Must have 3 years' experience in public health nursing, one year of which shall have been in supervisory capacity. For Grade III position one additional year of nursing and one additional year of supervisory experience required. Eligibility for certificate in public health nursing and registration as a nurse in Michigan. For further information write Michigan Civil Service Commission, 310 No. Grand Ave., Lansing 4, Mich.

Wanted: Medical Social Worker for Dept. of Health, Peoria, Ill. Address Director Maternal and Child Health, Dept. of Health, Peoria, Ill.

Industrial Hygiene Toxicologist. Calls for person of chemical or chemical engineering background. Position, supervising of chemical work of industrial hygiene service and industrial hygiene laboratory; designing special apparatus for field studies on occupational disease problems; conducting field and laboratory analyses of toxicological exposures in industry; keeping records, interpreting results and preparing records. Requirements, knowledge of chemical laboratory methods and equipment; procedures for qualitative and quantitative analysis of organic and inorganic chemistry; knowledge of chemical methods of determining toxic materials in industry; familiarity with petrographic methods of mineralogical analysis. Immediate temporary appointment will be made, to be followed later by civil service examination to determine permanent status. Salary $2,900 base, plus $100 a year war adjustment, or total of $3,000 per year. Travel expenses also allowed. Must be U. S. citizen. Resident of any state may apply. Write J. Lynn Mahaffey, M.D., Director of Health, State Department of Health, Trenton 7, N. J.

Wanted: Public Health Nurse. Salary $175 per month and full maintenance, plus $25 per month for car expense. Must furnish own car. Write Paul D. Crimm, M.D., Director Boehne Tuberculosis Hospital, Evansville 12, Ind.

Assistant Sanitarian in well established Ohio department of health. Minimum experience 2 years required. Merit system prevails. Salary $1,800–$2,400. Write **Box K**, Employment Service, A.P.H.A.

Wanted: A physician with venereal disease control experience to assume directorship of the Bureau of Venereal Diseases in a large northeastern city. Salary $4,500–$5,000 per year, plus cost of living adjustment and travel allowance. **Box E**, Employment Service, A.P.H.A.

Wanted: Physician (male), American citizen, draft exempt, trained in pediatrics, for a 3 year position as chief resident and research assistant in fine pediatric tuberculosis hospital, New York. Good salary and maintenance. Only one intensely interested in research need apply. Send full details of qualifications and photograph. **Box R**, Employment Service, A.P.H.A.

Wanted: X-ray technician to travel with portable x-ray unit taking chest x-rays at tuberculosis case finding clinics. Includes both industrial and school surveys. Salary $35 per week plus travel and maintenance when away from headquarters. Address **Box M**, Employment Service, A.P.H.A.

Physician wanted as Director of Maternal and Child Health in western county health department. Preferably with training in pediatrics and venereology. Some venereal disease control work also. Man preferred but woman considered. Must be in good health. Salary $4,500 per year with car and expenses furnished. Position for duration of war. Address **Box S**, Employment Service, A.P.H.A.

Tuberculosis Association in large western city seeks a director of medical social work. Attractive position now open in agency with a dynamic program closely related to official groups. Address **Box D**, Employment Service, A.P.H.A.

U. S. Indian Service seeks physicians for service in the United States and Alaska. Address Office of Indian Affairs, Health Division, Merchandise Mart, Chicago 54, Ill. Application blanks will be furnished upon request.

St. Louis, Mo., Health Division, Industrial Hygiene Service, seeks two industrial hygienists, either engineers or chemists. Salaries $225 to $250 per month depending on qualifications and experience, plus travel allowances. Address Robert M. Brown, Public Health Engineer, 64 Municipal Courts Bldg., St. Louis 3, Mo.

Wanted: Medical technologists for 550 bed approved California hospital. Give full particulars and state salary desired. Address W. O. Brown, M.D., Kern General Hospital, Bakersfield, Calif.

Wanted: Medical technologist, woman, trained in bacteriology of milk and water, diagnostic cultures, routine blood chemistry and tissue work—paraffin and frozen sections. County position under Civil Service located in the East Salary to be arranged. Write **Box L**, Employment Service, A.P.H.A.

Public Health Nurses Wanted: Three staff positions available. Generalized program. Annual salary $2,220 to $2,400 plus travel for use of own car. Address Miss Lorilla Britell, Supervisor, King County Health Dept., County-City Building, Seattle 4, Washington.

Health Department of Southern City and County in a rapidly expanding industrial area, population exceeding 200,000, wishes to employ a Director of Division of Preventable Diseases. Salary commensurate with training and experience, $4,100–$4,700 plus allowance for travel. Write **Box P**, Employment Service, A.P.H.A.

Wanted: Bacteriologist or serologist, junior grade, with public health experience preferred, to work in County Laboratory acting in capacity of a State Branch Laboratory. Permanent position, salary $168 per month with advancement if satisfactory. Apply to Dr. R. G. Beachley, Director of Health and Welfare, Arlington County Health Department, 1800 N. Edison St., Arlington, Va.

Nutritionist-dietician. Services of an outstanding nutritionist or dietician desired for research work in food industry. Salary ($5,000–$8,000) dependent on qualifications. Reply should state complete detailed educational background and experience. Apply **Box F**, Employment Service, A.P.H.A.

Community Health Educator. Wanted a woman, well trained and experienced in modern methods of organizing and conducting health education among neighborhood groups and other adults. Proper personal qualifications essential and would like person having Master's degree. Office with progressive private agency in city, but work chiefly in adjoining suburban and rural areas. Good salary and allowance for automobile expenses. State age, training, positions held, and give references. Address Arthur W. Towne, Secretary, Onondaga Health Association, Loew Building, Syracuse 2, N. Y.

Bacteriologist Wanted with minimum of master's degree in bacteriology and one year's experience in an approved public health laboratory. Woman or draft exempt man, to take charge of newly established, newly equipped laboratory. Must be able to carry out all the usual procedures of a public health laboratory. Write full details including minimum starting salary requirement. All letters including vitae and photo will be promptly acknowledged. Address E. E. Palmquist, M.D., King County Health Department, 402-L County-City Building, Seattle 4, Wash.

Wanted: A Vital Statistician to assume directorship of the Bureau of Vital Statistics in a large northeastern city. Salary $2,500–$3,100, plus cost of living adjustment. Write **Box G**, Employment Service, A.P.H.A.

Wanted: County Public Health Nurse for midwestern state. Present salary $160 per month and travel allowance. Must have had previous experience in public health. Own and drive car. Address District Health Unit 2, West Branch, Mich.

Physician—public health pediatrics. To assist director of maternal and child health in a large California County Health Department. Major duties, conducting of infant and preschool health conferences and school examinations. Beginning salary $390 a month and travel allowance. California license required. Training and experience in pediatrics or public health or both. Immediately available. Address William C. Buss, M.D., Kern County Health Dept., Bakersfield, Calif.

Wanted: Superintendent and Medical Director for tuberculosis sanatorium having 65 bed capacity and average of 35 patients per day. Salary $4,380 with $300 annual allowance for car. Write M. P. Hunter, City Manager, Roanoke, Va.

FOR OTHER POSITIONS AVAILABLE WRITE EMPLOYMENT SERVICE, AMERICAN PUBLIC HEALTH ASSOCIATION, 1790 BROADWAY, NEW YORK 19, N. Y.

In view of the current active demand for trained and experienced persons in public health, it is suggested that prospective employers communicate directly with the Employment Service, American Public Health Association, 1790 Broadway, New York 19, N. Y., for up-to-date lists of applicants.

POSITIONS WANTED

Administrative

Woman physician, experienced in public health education and school health service administration and supervision, seeks full- or part-time position, preferably southeastern New York State. **A-511**

Health Education

Woman with background of health education and public health nursing, experienced as teacher, supervisor, and writer, seeks teaching position of responsibility. **H-507**

Engineer

Well qualified public health engineer seeks responsible position in New York metropolitan area. **E-480**

Sanitary Engineer, C.E. 22 years' experience as sanitary engineer, 14 as director in state health department, now employed. Desires change. Location immaterial. **E-481**

Laboratory

Research bacteriologist. Unusually trained and experienced woman bacteriologist and serologist now occupying responsible position in state laboratory seeks research work of permanent character. **L-468**

Water chemist, bacteriologist. M.S. degree in Sanitary Chemistry. Age 36, draft exempt. Eight years' experience in state laboratory working on water, milk and sewage. Prefers Midwest or Pacific Northwest location. **L-469**

Research bacteriologist - veterinarian, now in civil service, desires change to direct or indirect war work. P-3 classification. Considerable laboratory and field experience. Used to foreign travel; will go anywhere. Steady hard worker. **L-470**

Bacteriologist, 29, draft exempt, 3 years' experience public health laboratory, 2 years' experience industrial organization. Experienced in investigation and control activities on water, sewage, and sanitation as chemist, bacteriologist and serologist in syphilis and enteric diseases. **L-465**

Bacteriologist-Serologist, male, with 20 years' experience in state and municipal public health laboratories, last 10 years in administrative capacity, now in charge of a midwest diagnostic laboratory, wishes to make a permanent change. **L-427**

Miscellaneous

Public Health Nurse. B.S. in nursing, William and Mary College, age 53, seeks position as coördinator of public health nursing, educational director, or director student nurse public health program. Prefers Middle Atlantic States. **M-452**

NEWS FROM THE FIELD

MICHIGAN STATE COUNCIL OF HEALTH

At the first meeting of the Michigan State Council of Health held since the appointment of William DeKleine, M.D., as State Commissioner of Health, Henry F. Vaughan, Dr.P.H., Dean, School of Public Health, University of Michigan, was reëlected President of the Council, a position which Dr. Vaughan has held for the past five years. The other members of the Council include Harold E. Wisner, M.D., Detroit; John A. Galbo, D.D.S., Detroit; Wesley H. Mast, M.D., Petoskey; Charles L. Hess, M.D., Bay City.

PUBLIC HEALTH ASSOCIATION OF NEW YORK CITY

The Eighth Annual Meeting of the Public Health Association of New York City was held on May 17.

The proceedings opened with a session in the afternoon on "Debits and Credits in Public Health in Wartime in Our City." The three speakers were: Dr. Leona Baumgartner, Director, Bureau of Child Hygiene, Department of Health of the City of New York; Bailey B. Burritt, Chairman, Executive Council, Community Service Society; and Dr. Theodore Rosenthal, Director, Bureau of Social Hygiene, Department of Health of the City of New York.

At the dinner session, the speaker of the evening was Lt. Col. Paul H. Stevenson, Senior Surgeon (R), U. S. Public Health Service, who has recently returned from Burma. His topic was "Expanding Horizons."

Dr. John L. Rice, on behalf of the American Public Health Association, gave a brief report on the plans for the Second Wartime Conference of the A.P.H.A. to be held in October at Hotel Pennsylvania in New York. He read a message from Dr. Reginald M. Atwater, Executive Secretary of the A.P.H.A., urging all the local members to attend the sessions.

The officers elected to serve until the Annual Meeting in 1945, were:

President—Leverett D. Bristol, M.D.
First Vice-President—Sol Pincus, C.E.
Second Vice-President—John L. Rice, M.D.
Secretary-Treasurer—Frank Kiernan
New members of the Executive Board:
Arthur I. Blau, M.D.
Horace Hughes
Helen C. Manzer, Ph.D.
Gertrude Gates Mudge
Boyden Roseberry

Frank Kiernan was elected as representative to the Governing Council of the American Public Health Association.

NEW OFFICERS ELECTED AT RECENT MEETINGS OF SOME OF THE A.P.H.A. AFFILIATED SOCIETIES

West Virginia Public Health Association:

President—Edward B. Carroll, Morgantown
1st Vice-President—Margaret D. Arbuckle, Grantsville
2nd Vice-President—James E. Coleman, M.D., Fayetteville
Secretary-Treasurer—Annette King, Charleston

Illinois Public Health Association:

President—Sumner M. Miller, M.D., Peoria
President-elect—Howard J. Shaughnessy, Ph.D., Chicago
Secretary-Treasurer—Edward A. Piszczek, M.D., Chicago

Georgia Public Health Association:

President—Earl J. Sunkes, Dr.P.H., Atlanta
President-elect—Abe J. Davis, M.D., Augusta
Vice-President—Frances Sanchez, Albany
Secretary-Treasurer and Representative to the A.P.H.A. Governing Council—Louva G. Lenert, Atlanta

Connecticut Public health Association:

President—Mario L. Palmieri, M.D., Middletown
President-elect—Robert E. Purdue, M.D., Norwalk
Vice-President—Richard J. Hinchey, M.D., Waterbury
Secretary-Treasurer—Clement F. Batelli, M.D., New Haven
Representative to A.P.H.A. Governing Council—Paul H. Brown, M.D., Stamford
Alternate to A.P.H.A. Governing Council—Alfred L. Burgdorf, M.D., Hartford

Utah Public Health Association:

President—Eugene H. Bramhall, Salt Lake City
President-elect—Thomas L. Martin, Ph.D., Provo
Vice-President—LaVerna Peterson, R.N., Ogden
Treasurer—Welby W. Bigelow, M.D., Salt Lake City
Secretary—Elmer B. Quist, Salt Lake City

Idaho Public Health Association:

President—Milo T. Means, Boise
1st Vice-President—Stuart Robinson, D.D.S., Gooding
2nd Vice-President—Mrs. H. J. Maughan, Preston
3rd Vice-President—Mrs. Emma Clouchek, Twin Falls
4th Vice-President—Mrs. R. L. Brainard, Wardner
5th Vice-President—Mrs. R. A. Pomeroy, Twin Falls
Secretary—John W. Wright, Boise
Treasurer—Lucy Higgins, Boise

CORRECTION

In the JOURNAL for April, 1944, pages 335 and 347 in listing the members of the Commission on Acute Respiratory Diseases, inadvertently the name of Dr. A. E. Feller was omitted. The members are: Drs. John H. Dingle, Director, T. J. Abernethy, G. F. Badger, J. W. Beard, N. L. Cressy, Major M.C., A. E. Feller, A. D. Langmuir, C. H. Rammelkamp, J. M. Ruegsegger (resigned), and E. Strauss, 1st Lt., M.C.

PERSONALS

Central States

GEORGE F. CAMPANA, M.D.,† has been appointed Acting State Health Officer to succeed F. J. HILL, M.D.,† who has resigned as State Health Officer for North Dakota to accept the city health officership for Minneapolis, Minn. . Dr. Campana has served as Director of the Division of Preventable Diseases of the North Dakota Department of Health since June, 1943, coming to Bismarck from New Rochelle, N. Y., where he was Acting City Health Officer.

JOHN H. GILPIN, M.D., Cheboygan, Mich., has been appointed District Health Officer of Cheboygan, Presque Isle, Montmorency, and Alpena Counties.

FRANK J. HILL, M.D., M.P.H.,† who for about three years has been State Health Officer of Bismarck, N. D., has resigned to accept appointment as City Health Commissioner of Minneapolis, Minn., succeeding F. E. HARRINGTON, M.D.,† who is retiring.

HUGO V. HULLERMAN, M.D., M.S. P.H.,* has been appointed Secretary of the Council on Professional Practice of the American Hospital Association, Washington, D. C. Dr. Hullerman was formerly Chief of the Division of Maternal and Child Health of the Illinois Department of Public Health, Springfield, Ill.

ALBERT T. PETERSON, formerly Director, Field Service with the Middle-

* Fellow A.P.H.A.
† Member A.P.H.A.

sex County Tuberculosis and Health League, New Brunswick, N. J., has recently accepted a position with the Denver Tuberculosis Society, Denver, Colo., as Health Education Secretary. Mr. Peterson is a graduate of Northwestern University and has had college teaching experience in the Midwest and in the East.

MARY E. SOULES, M.D., M.P.H.,† Director of Maternal and Child Hygiene for the North Dakota State Department of Health, Bismarck, N. D., has resigned.

BUELL H. VAN LEUVEN, M.D.,† Traverse City, Mich., has been appointed Health Director of Chippewa County, Mich.

JOHN P. WALSH, M.D.,† Wheaton, Ill., Health Officer of DuPage County, has been transferred to supervise a five county health unit with headquarters at Dixon.

Eastern States

JOHN HALL,* Freehold, N. J., recently Director of Health Education with the U. S. Public Health Service has been appointed Field Assistant with the American Social Hygiene Association, New York, N. Y. His first assignment is to the 8th Army Service Command, Texas, Oklahoma, New Mexico, Arkansas and Louisiana.

EMMA M. VARNERIN, M.D., has been appointed Assistant District Health Officer of the Division of Communicable Disease, State Department of Health, Boston, Mass.

Southern States

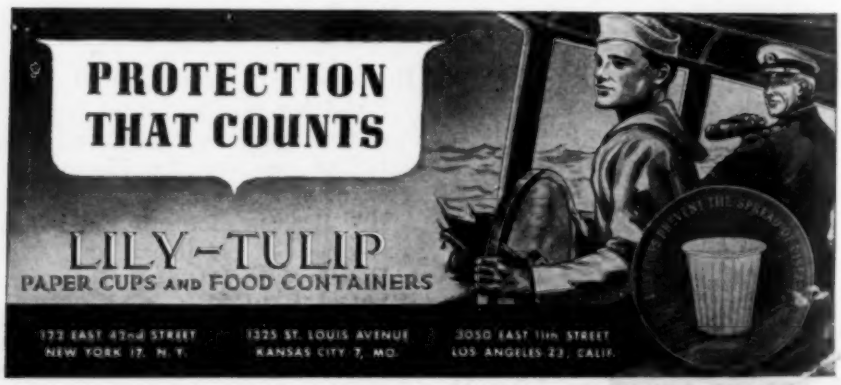
MARGARET H. ERVIN,† formerly with the Bellemead Coal Company, Sabine, W. Va., has accepted an appointment to the staff of the Laird Memorial Hospital, Montgomery, W. Va., as a clinical technician.

JAMES A. HAYNE, M.D.,* Columbia, S. C., State Health Officer for 33 years, has resigned.

BALLARD NORWOOD, JR., M.D.,† Oxford, N. C., has resigned as Health Officer of Granville County, N. C., to enter private practice.

BRIGADIER GENERAL JAMES STEVENS SIMMONS,* U. S. Army, Chief of the Preventive Medicine Service, Office of the Surgeon General, U. S. Army, Washington, D. C., has been elected as a member of the Council on Industrial Health of the American Medical Association.

* Fellow A.P.H.A.
† Member A.P.H.A.



LEO B. SKEEN, M.D.,† Statesville, N. C., has resigned as Health Officer of Iredell County to enter the practice of medicine.

Western States

CECIL W. McCAIN, M.D., has been appointed Health Officer of Hood River County, Ore.

WAYNE S. RAMSEY, M.D., Portland, Ore., has been appointed Deschutes County Health Officer with headquarters in Bend.

CONFERENCES AND DATES

American Association for the Advancement of Science—Annual Meeting and Annual Science Exhibition. Cleveland, Ohio. September 11–16.

American Congress of Physical Therapy—23rd Annual Scientific and Clinical Session. Hotel Statler, Cleveland, Ohio. September 6–9.

American Dietetic Association—27th Annual Meeting. Palmer House, Chicago, Ill. October 25–27.

American Public Health Association—Second Wartime Public Health Conference and 73rd Annual Business Meeting. Hotel Pennsylvania, New York, N. Y. October 3–5.

American Public Works Association. St. Paul, Minn. September 24–27.

American Society of Civil Engineers—Summer Meeting. Cleveland, Ohio, July 19–21.

American Water Works Association—
North Dakota Water and Sewage Works Conference—Grand Pacific Hotel, Bismarck, N. D. September 12–13.
Western Pennsylvania Section—Roosevelt Hotel, Pittsburgh, Pa. September 13–14.
Rocky Mountain Section—Cosmopolitan Hotel, Denver, Colo. September 21–22.
Southwest Section—Hotels Stephen F. Austin and Driskill, Austin, Tex. October 17–19.
Missouri Valley Section—President Hotel, Kansas City, Mo. October 23–24.
California Section—Biltmore Hotel, Los Angeles, Calif. October 24–26.
New Jersey Section—Atlantic City, N. J. November 2–4.
Four States Section—Benjamin Franklin Hotel, Philadelphia, Pa. November 8–10.
Florida Section—Suwanee Hotel, St. Petersburg Fla. November 16–18.

Association of Military Surgeons of the United States. Hotel Pennsylvania, New York, N. Y. November 2–4.

Biological Photographic Association—14th Annual Meeting. Binghamton, N. Y. September 7–9.

Federation of Sewage Works Associations. William Penn Hotel, Pittsburgh, Pa. October 12–14.

International College of Surgeons—Ninth Annual Assembly. Benjamin Franklin Hotel, Philadelphia, Pa. October 3–5.

National Chemical Exposition—Sponsored by the Chicago Section of the American Chemical Society. The Coliseum, Chicago, Ill. November 15–19.

National Education Association. Pittsburgh, Pa. July 4–7.

New York State Association of Milk Sanitarians—Annual Meeting. Hotel Syracuse, Syracuse, N. Y. September 20–22.

Pennsylvania Sewage Works Association—Seventeenth Annual Conference. William Penn Hotel, Pittsburgh, Pa. October 12–14.

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Control and prevention of ropy milk begins on the dairy farm . . . likewise demands rigid measures of sanitation throughout the dairy plant. Both on the farm and in the dairy plant, Diversol, the quick-acting chlorine bactericide has proven most effective for all disinfecting operations.

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COLORADO PUBLIC HEALTH ASSOCIATION
Evelyn Horton, R.N., Metropolitan Life Insurance Company, Denver.
CONNECTICUT PUBLIC HEALTH ASSOCIATION
Clement F. Batelli, M.D., City Hall, New Haven
CUBAN PUBLIC HEALTH SOCIETY
Dr. Jose F. Rodriguez-Perez, Instituto Finlay, Havana
FLORIDA PUBLIC HEALTH ASSOCIATION
Edward M. L'Engle, M.D., P. O. Box 210, Jacksonville.
GEORGIA PUBLIC HEALTH ASSOCIATION
Louva G. Lenert, 245 State Office Building, Atlanta.
IDAHO PUBLIC HEALTH ASSOCIATION
John W. Wright, Box 637, Lewiston.
ILLINOIS PUBLIC HEALTH ASSOCIATION
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IOWA PUBLIC HEALTH ASSOCIATION
Carl F. Jordan, M.D., State Department of Health, Des Moines.
KANSAS PUBLIC HEALTH ASSOCIATION
R. M. Sorenson, M.D., State Board of Health, Topeka
MASSACHUSETTS PUBLIC HEALTH ASSOCIATION
Alexander A. Robertson, Health Department, Newton
MICHIGAN PUBLIC HEALTH ASSOCIATION
Marjorie Delavan, State Department of Health, Lansing.
MISSOURI PUBLIC HEALTH ASSOCIATION
J. Warren Smith, State Board of Health, Jefferson City.
NEW MEXICO PUBLIC HEALTH ASSOCIATION
Geneva Hunter, P. O. Box 185, Wagon Mound.
NORTHERN CALIFORNIA PUBLIC HEALTH ASSOCIATION
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PUBLIC HEALTH ASSOCIATION OF NEW YORK CITY
Frank Kiernan, 386 Fourth Avenue, New York
PUERTO RICO PUBLIC HEALTH ASSOCIATION
Guillermo Arbona, M.D., Box 7155, Santurce, P. R.
SOUTH CAROLINA PUBLIC HEALTH ASSOCIATION
Mrs. Frank George, R.N., State Board of Health, Columbia.
SOUTHERN CALIFORNIA PUBLIC HEALTH ASSOCIATION
Frank D. Sweger, 116 W. Temple St., Los Angeles.
TENNESSEE PUBLIC HEALTH ASSOCIATION
Robert H. Hutcheson, M.D., State Department of Health, Nashville.
TEXAS PUBLIC HEALTH ASSOCIATION
Alan C. Love, Third Floor, City Hall, Waco.
UTAH PUBLIC HEALTH ASSOCIATION
Elmer B. Quist, 124 State Capitol, Salt Lake City.
WEST VIRGINIA PUBLIC HEALTH ASSOCIATION
Annette King, State Department of Health, Charleston.
SOUTHERN BRANCH, A.P.H.A.
Robert H. Hutcheson, M.D., State Department of Health, Nashville, Tenn.
WESTERN BRANCH, A.P.H.A.
W. Ford Higby, 45 Second Street, San Francisco, Calif.

Request for Application for Membership

I wish to apply for membership in the American Public Health Association. Please send me an application blank.

Name .....
Print name in full and give degree

Address .....

Public health occupation .....

REQUIREMENTS. Persons professionally engaged or interested in public health work are eligible for election as Members of the Association.

DUES: Dues of Members are $5.00 per year, which includes subscription to the **AMERICAN JOURNAL OF PUBLIC HEALTH**, and use of the Book Service, Employment Service and Information Service. Persons joining the Association after July 1 are requested to pay $7.50, covering a year and one half from July, 1944, to December, 1945.

AMERICAN PUBLIC HEALTH ASSOCIATION

1790 BROADWAY AT 58TH STREET, NEW YORK 19, N. Y.